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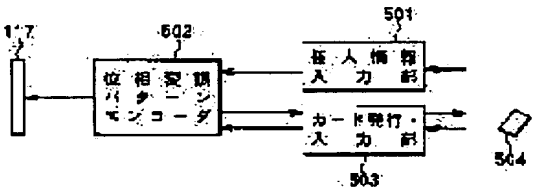
(54) OPTICAL INFORMATION RECORDER AND OPTICAL INFORMATION REPRODUCING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To allow constitution to be small as to an optical system for the recording or reproducing operation and also to easily realize security protection.
SOLUTION: On an optical information recording medium, information is recorded by an interference pattern due to an interference between information light carrying the information and a reference light for recording, in which a phase of the light is spatially modulated by a phase space modulator. When the information peculiar to the individual is inputted to an individual information input part 501, a modulation pattern of the phase of the reference light is prepared by a phase modulation pattern encoder 502 based on the information inputted from the individual information input part 501, the information of the generated modulation pattern is given to the phase space modulator at information recording and the phase space modulator is driven. Thus, the information is recorded on the optical information recording medium by being corresponded to the modulation pattern of the phase of the reference light generated based on the information of peculiar the individual.



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CLAIMS

[Claim(s)]
[Claim 1] An individual humanity news input means to input the individual humanity news which is an optical information recording device for recording information to the optical information record medium equipped with the information recording layer on which information is recorded using holography, and is the information on an individual proper, An information light generation means to generate the information light which supported the information which should be recorded, and a phase modulation means to modulate the phase of light spatially are included. A reference beam generation means for record to modulate the phase of light spatially and to generate the reference beam for record with said phase modulation means based on phase modulation pattern information, A phase modulation pattern generation means to generate said phase modulation pattern information based on said individual humanity news inputted by said individual humanity news input means, So that said information which should be recorded may be recorded on said information recording layer with the interference pattern by interference with said information light and said reference beam for record The optical information recording device characterized by having said information light and said reference beam for record with the record optical system which irradiates said information recording layer so that these opticals axis may be arranged on the same line.
[Claim 2] Said information which should be recorded is an optical information recording device according to claim 1 characterized by what it is matched with said phase modulation pattern information generated by said phase modulation pattern generation means, and is recorded on said information recording layer.
[Claim 3] Said record optical system is an optical information recording device according to claim 1 characterized by irradiating said information light and said reference beam for record from the same field side to said information recording layer.
[Claim 4] Furthermore, the optical information recording device according to claim 1 characterized by having an issue means to publish the record medium for authentication which recorded said phase modulation pattern information.
[Claim 5] With the interference pattern by interference with the reference beam for record by which the phase of light was spatially modulated according to the 1st phase modulation pattern information generated based on the individual humanity news which is the information on the proper of information light and an individual which supported the information which should be recorded Holography is used from the optical information record medium equipped with the information recording layer on which said information which should be recorded was recorded. A phase modulation pattern information acquisition means to be an optical information regenerative apparatus for reproducing the recorded information, and to acquire the 2nd phase modulation pattern information, While irradiating a reference beam generation means for playback to modulate the phase of light spatially based on said 2nd phase modulation pattern information, and to generate the reference beam for playback, and said reference beam for playback at said information recording layer It has the playback optical system which collects the playback light generated from said information recording layer only when said 2nd phase modulation pattern information is in agreement with said 1st phase modulation pattern information. Said playback optical system is an optical information regenerative apparatus characterized by performing exposure of said reference beam for playback, and collection of said playback light so that the optical axis of said reference beam for playback and the optical axis of said playback light may be arranged on the same line.
[Claim 6] The information recorded on said optical information record medium is an optical information regenerative apparatus according to claim 5 characterized by what it is matched with said 1st phase modulation pattern information, and is recorded on said information recording layer.
[Claim 7] Said playback optical system is an optical information regenerative apparatus according to claim 5

characterized by collecting said playback light from the same field side as the side which irradiates said reference beam for playback in said information recording layer.
[Claim 8] Said phase modulation pattern information acquisition means is an optical information regenerative apparatus according to claim 5 characterized by having the input section which inputs the 2nd individual humanity news which is the information on an individual proper, and a means to generate said 2nd phase modulation pattern information based on the 2nd individual humanity news inputted by this input section.
[Claim 9] Said phase modulation pattern information acquisition means is an optical information regenerative apparatus according to claim 5 characterized by acquiring said 2nd phase modulation pattern information from the record medium for authentication which recorded said 2nd phase modulation pattern information.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the optical information recording device which records information on an optical information record medium using holography, and the optical information regenerative apparatus which reproduces information from an optical information record medium using holography.
[0002]
[Description of the Prior Art] Holographic record which records information on a record medium using holography is performed by writing the interference fringe which can generally do light with image information, and a reference beam superposition and then inside a record medium in a record medium. At the time of playback of the recorded information, image information is reproduced by irradiating a reference beam at the record medium by the diffraction by the interference fringe.
[0003] In recent years, for super-high density optical recording, volume holography, especially digital volume holography are developed in a practical use region, and attract attention. Volume holography is a method with which it utilizes positively and the thickness direction of a record medium also writes in an interference fringe in three dimension, diffraction efficiency is raised by increasing thickness and there is the description that increase of storage capacity can be aimed at using multiplex record. And with digital volume holography, although volume holography, the same record medium, and a recording method are used, the image information to record is the computer-oriented holographic recording method limited to the digital pattern made binary. In this digital volume holography, it once digitizes, and develops to two-dimensional digital pattern information, and image information like an analog--, for example picture also records this as image information. At the time of playback, it is reading and decoding this digital pattern information, and it is returned and displayed on the original image information. It becomes possible to reproduce the information on original very faithfully by performing differential detection, or coding binary-ized data and performing an error correction by this, at the time of playback, even if an SN ratio (S/N) is somewhat bad.
[0004] Drawing 75 is the perspective view showing the configuration of the outline of the record reversion system in the conventional digital volume holography. The space optical modulator 101 with which this record reversion system generates the information light 102 based on two-dimensional digital pattern information, The lens 103 which the information light 102 from this space optical modulator 101 is condensed, and is irradiated to the hologram record medium 100, A reference beam exposure means to irradiate a reference beam 104 from the direction which carries out an abbreviation rectangular cross with the information light 102 to the hologram record medium 100 (not shown), It has the lens 106 which condenses the playback light 105 by which outgoing radiation is carried out from the CCD (charge-coupled device) array 107 and the hologram record medium 100 for detecting the reproduced two-dimensional digital pattern information, and irradiates on the CCD array 107. The crystal of LiNbO3 grade is used for the hologram record medium 100.
[0005] In the record reversion system shown in drawing 75 , at the time of record, the information on the subject-copy image to record is digitized, the signal of 0 or 1 is further arranged to two-dimensional, and two-dimensional digital pattern information is generated. One two-dimensional digital pattern information is called page data. Here, multiplex record of the page data of #1 - #n shall be carried out at the same hologram record medium 100. In this case, first, based on page data #1, by choosing transparency or protection from light for every pixel with the space optical modulator 101, the information light 102 modulated spatially is generated and the hologram record medium 100 is irradiated through a lens 103. A reference beam 104 is

irradiated at the hologram record medium 100 from the direction theta 1 which carries out an abbreviation rectangular cross with the information light 102, and the interference fringe made by the superposition of the information light 102 and a reference beam 104 inside the hologram record medium 100 is recorded on coincidence. In addition, in order to raise diffraction efficiency, a reference beam 104 deforms into a flat beam by a cylindrical lens etc., and an interference fringe crosses even in the thickness direction of the hologram record medium 100, and is recorded. At the time of the following record of page data #2, a reference beam 104 is irradiated from a different include angle theta 2 from theta 1, and multiplex record of the information can be carried out to the same hologram record medium 100 by piling up this reference beam 104 and the information light 102. Similarly, at the time of record of other page data #3 - #n, a reference beam 104 is irradiated from include-angle theta3-thetan different, respectively, and multiplex record of the information is carried out. Thus, information calls a stack the hologram by which multiplex record was carried out. In the example shown in drawing 75 , the hologram record medium 100 has two or more stacks (a stack 1, a stack 2, --, Stack m, --).

[0006] What is necessary is just to irradiate the reference beam 104 of whenever [same incident angle / as the time of recording the page data] at the stack, in order to reproduce the page data of arbitration from a stack. If it does so, the reference beam 104 will be alternatively diffracted by the interference fringe corresponding to the page data, and the playback light 105 will generate it by it. Incidence of this playback light 105 is carried out to the CCD array 107 through a lens 106, and the two-dimensional pattern of playback light is detected by the CCD array 107. And the information on a subject-copy image etc. is reproduced by decoding the two-dimensional pattern of the detected playback light contrary to the time of record.

[0007]

[Problem(s) to be Solved by the Invention] Although multiplex record of the information can be carried out with the configuration shown in drawing 75 at the same hologram record medium 100, in order to record information on super-high density, positioning of the information light 102 and the reference beam 104 to the hologram record medium 100 becomes important. However, with the configuration shown in drawing 75 , since there is no information for positioning in hologram record-medium 100 the very thing, positioning of the information light 102 and the reference beam 104 to the hologram record medium 100 must be performed mechanically, and high positioning of precision is difficult. Therefore, while a remover kinky thread tee (ease of moving a hologram record medium from a certain record regenerative apparatus to other record regenerative apparatus, and performing same record playback) is bad and random access is difficult, there is a trouble that high density record is difficult. Furthermore, with the configuration shown in drawing 75 , since each optical axis of the information light 102, a reference beam 104, and the playback light 105 is arranged in a location which is mutually different spatially, there is a trouble that the optical system for record or playback is enlarged.

[0008] This invention was made in view of this trouble, and it is the optical information recording device which records information on an optical information record medium using holography, and the optical information regenerative apparatus which reproduce information from an optical information record medium using holography, and the purpose is to offer the optical information recording device and the optical information regenerative apparatus which enabled it to realize a security protection easily while being able to constitute the optical system for record or playback small.

[0009]

[Means for Solving the Problem] An individual humanity news input means to input the individual humanity news which the optical information recording device of this invention is equipment for recording information to the optical information record medium equipped with the information recording layer on which information is recorded using holography, and is the information on an individual proper, An information light generation means to generate the information light which supported the information which should be recorded, and a phase modulation means to modulate the phase of light spatially are included. A reference beam generation means for record to modulate the phase of light spatially and to generate the reference beam for record with a phase modulation means based on phase modulation pattern information, A phase modulation pattern generation means to generate phase modulation pattern information based on the individual humanity news inputted by the individual humanity news input means, It has information light and a reference beam for record with the record optical system which irradiates an information recording layer so that these opticals axis may be arranged on the same line so that the information which should be recorded on an information recording layer with the interference pattern by interference with information light and the reference beam for record may be recorded.

[0010] In the optical information recording device of this invention, phase modulation pattern information is generated based on individual humanity news, and the reference beam for record is generated based on this phase modulation pattern information. And the information which should be recorded is recorded on the information recording layer of an optical information record medium with the interference pattern by interference with information light and the reference beam for record.
[0011] In the optical information recording device of this invention, the information which should be recorded may be matched with the phase modulation pattern information generated by the phase modulation pattern generation means, and may be recorded on an information recording layer.
[0012] Moreover, in the optical information recording device of this invention, record optical system may irradiate information light and the reference beam for record from the same field side to an information recording layer.
[0013] Moreover, the optical information recording device of this invention may be equipped with an issue means to publish further the record medium for authentication which recorded phase modulation pattern information.
[0014] The optical information regenerative apparatus of this invention With the interference pattern by interference with the reference beam for record by which the phase of light was spatially modulated according to the 1st phase modulation pattern information generated based on the individual humanity news which is the information on the proper of information light and an individual which supported the information which should be recorded Holography is used from the optical information record medium equipped with the information recording layer on which the information which should be recorded was recorded. A phase modulation pattern information acquisition means to be equipment for reproducing the recorded information and to acquire the 2nd phase modulation pattern information, While irradiating a reference beam generation means for playback to modulate the phase of light spatially based on the 2nd phase modulation pattern information, and to generate the reference beam for playback, and the reference beam for playback at an information recording layer It has the playback optical system which collects the playback light generated from an information recording layer only when the 2nd phase modulation pattern information is in agreement with the 1st phase modulation pattern information. Playback optical system Exposure of the reference beam for playback and collection of playback light are performed so that the optical axis of the reference beam for playback and the optical axis of playback light may be arranged on the same line.
[0015] In the optical information regenerative apparatus of this invention, the reference beam for playback is generated based on the 2nd phase modulation pattern information, and this reference beam for playback is irradiated by the information recording layer of an optical information record medium. And only when the 2nd phase modulation pattern information is in agreement with the 1st phase modulation pattern information, the playback light generated from an information recording layer is collected.
[0016] In the optical information regenerative apparatus of this invention, the information recorded on the optical information record medium may be matched with the 1st phase modulation pattern information, and may be recorded on the information recording layer.
[0017] Moreover, in the optical information regenerative apparatus of this invention, playback optical system may collect playback light from the same field side as the side which irradiates the reference beam for playback in an information recording layer.
[0018] Moreover, in the optical information regenerative apparatus of this invention, the phase modulation pattern information acquisition means may have the input section which inputs the 2nd individual humanity news which is the information on an individual proper, and a means to generate the 2nd phase modulation pattern information based on the 2nd individual humanity news inputted by this input section.
[0019] Moreover, in the optical information regenerative apparatus of this invention, a phase modulation pattern information acquisition means may acquire the 2nd phase modulation pattern information from the record medium for authentication which recorded the 2nd phase modulation pattern information.
[0020]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail with reference to a drawing. The gestalt of operation of the 1st of this invention is the example which enabled multiplex record by phase-encoding (phase encoding) multiplex. The explanatory view showing the configuration of the optical information record medium in the gestalt of the pickup (only henceforth pickup) in the optical information record regenerative apparatus which drawing 1 requires for the gestalt of this operation, and this operation, and drawing 2 are the block diagrams showing the whole optical information record regenerative-apparatus configuration concerning the gestalt of this operation. In addition, the optical

information record regenerative apparatus contains the optical information recording device and the optical information regenerative apparatus.
[0021] With reference to introduction and drawing 1 , the configuration of the optical information record medium in the gestalt of this operation is explained. This optical information record medium 1 carries out the laminating of the hologram layer 3 as an information recording layer by which information is recorded on the whole surface of the disc-like transparence substrate 2 formed of the polycarbonate etc. using volume holography, the reflective film 5, and the protective layer 4 in this sequence, and is constituted. The address servo area 6 as two or more positioning fields which extend in radial at a line is established in the interface of the hologram layer 3 and a protective layer 4 at intervals of a predetermined include angle, and the section of the sector between the adjacent address servo area 6 has become a data area 7. Information and address information for a sample DOSABO method to perform a focus servo and a tracking servo are beforehand recorded on the address servo area 6 by the embossing pit etc. In addition, a focus servo can be performed using the reflector of the reflective film 5. As information for performing a tracking servo, a wobble pit can be used, for example. The transparence substrate 2 makes the proper thickness of 0.6mm or less, and the hologram layer 3 the proper thickness of 10 micrometers or more. The hologram layer 3 is formed with the hologram ingredient from which optical properties, such as a refractive index, a dielectric constant, and a reflection factor, change according to luminous intensity, when light is irradiated. as a hologram ingredient -- for example, the E. I. du Pont de Nemours& Co. (Dupont) make -- photopolymer (photopolymers) HRF-600 (product name) etc. is used. The reflective film 5 is formed of aluminum.
[0022] Next, with reference to drawing 2 , the configuration of the optical information record regenerative apparatus concerning the gestalt of this operation is explained. This optical information record regenerative apparatus 10 is equipped with the spindle 81 with which the optical information record medium 1 is attached, the spindle motor 82 made to rotate this spindle 81, and the spindle servo circuit 83 which controls a spindle motor 82 to maintain the number of rotations of the optical information record medium 1 at a predetermined value. While the optical information record regenerative apparatus 10 irradiates information light and the reference beam for record to the optical information record medium 1 and records information further The reference beam for playback was irradiated to the optical information record medium 1, playback light was detected, and it has the pickup 11 for reproducing the information currently recorded on the optical information record medium 1, and the driving gear 84 which makes this pickup 11 movable to radial [of the optical information record medium 1].
[0023] The detector 85 for the optical information record regenerative apparatus 10 to detect focal error signal FE, the tracking error signal TE, and a regenerative signal RF from the output signal of pickup 11 further, It is based on focal error signal FE detected by this detector 85. The focus servo circuit 86 which drives the actuator in pickup 11, is made to move an objective lens in the thickness direction of the optical information record medium 1, and performs a focus servo, The tracking servo circuit 87 which drives the actuator in pickup 11 based on the tracking error signal TE detected by the detector 85, is made to move an objective lens to radial [of the optical information record medium 1], and performs a tracking servo, It has the slide servo circuit 88 which performs the slide servo which a driving gear 84 is controlled [servo] based on the command from the tracking error signal TE and the controller mentioned later, and moves pickup 11 to radial [of the optical information record medium 1].
[0024] The optical information record regenerative apparatus 10 decodes further the output data of a CCD array later mentioned in pickup 11. The digital disposal circuit 89 which reproduces the data recorded on the data area 7 of the optical information record medium 1, reproduces a basic clock from the regenerative signal RF from a detector 85, or distinguishes the address, It has the controller 90 which controls the optical whole information record regenerative apparatus 10, and the control unit 91 which gives various directions to this controller 90. A controller 90 controls pickup 11, the spindle servo circuit 83, and slide servo circuit 88 grade while inputting the basic clock and address information which are outputted from a digital disposal circuit 89. The spindle servo circuit 83 inputs the basic clock outputted from a digital disposal circuit 89. A controller 90 realizes the function of a controller 90 by having CPU (central processing unit), ROM (read only memory), and RAM (random access memory), and CPU's making RAM a working area, and performing the program stored in ROM.
[0025] Next, with reference to drawing 1 , the configuration of the pickup 11 in the gestalt of this operation is explained. Pickup 11 is equipped with 2 division rotatory-polarization plate 14 and the prism block 15 which were arranged in the opposite side of the optical information record medium [in / for the objective lens 12 which counters the transparence substrate 2 side of the optical information record medium 1, and this objective lens 12 / the actuator 13 movable to radial / of the optical information record medium 1 / the

thickness direction and radial /, and an objective lens 12] 1 sequentially from the objective lens 12 side when the optical information record medium 1 is fixed to a spindle 81. 2 division rotatory-polarization plate 14 has rotatory-polarization plate 14L arranged in drawing 1 at the left-hand side part of an optical axis, and rotatory-polarization plate 14R arranged in drawing 1 at the right-hand side part of an optical axis. Rotatory-polarization plate 14L rotates the +45 degrees of the polarization directions, and rotatory-polarization plate 14R rotates the -45 degrees of the polarization directions. The prism block 15 has semi-reflection surface 15a and reflector 15b which have been arranged sequentially from 2 division rotatory-polarization plate 14 side. The 45 degrees of that direction of a normal are both leaned to the direction of an optical axis of an objective lens 12, and this semi-reflection surface 15a and reflector 15b are arranged in parallel mutually.

[0026] Pickup 11 is further equipped with the prism block 19 arranged in the side of the prism block 15. The prism block 19 is arranged in the location corresponding to semi-reflection surface 15a of the prism block 15, is arranged in reflector 19a parallel to semi-reflection surface 15a, and the location corresponding to reflector 15b, and has semi-reflection surface 19b parallel to reflector 15b.

[0027] Pickup 11 is further equipped with the convex lens 16 and the phase space optical modulator 17 which have been arranged in order [side / prism block 15] in between the prism block 15 and the prism blocks 19 in the location corresponding to semi-reflection surface 15a and reflector 19a, and the space optical modulator 18 arranged in between the prism block 15 and the prism blocks 19 in the location corresponding to reflector 15b and semi-reflection surface 19b.

[0028] The phase space optical modulator 17 has the pixel of a large number arranged in the shape of a grid, and can modulate the phase of light now spatially by choosing the phase of outgoing radiation light for every pixel. A liquid crystal device can be used as this phase space optical modulator 17.

[0029] By having the pixel of a large number arranged in the shape of a grid, and choosing the transparency condition and cut off state of light for every pixel, the space optical modulator 18 can modulate light spatially with optical reinforcement, and can generate now the information light which supported information. A liquid crystal device can be used as this space optical modulator 18. The space optical modulator 18 constitutes the information light generation means in this invention.

[0030] Further, pickup 11 is equipped with the CCD array 20 as a detection means arranged in the direction reflected by semi-reflection surface 19b of the prism block 19, after the return light from the optical information record medium 1 passes the space optical modulator 18.

[0031] Pickup 11 equips the side of the opposite side with the beam splitter 23, the collimator lens 24, and light equipment 25 which have been arranged sequentially from the prism block 19 side in the space optical modulator 18 in the prism block 19 further. The beam splitter 23 has semi-reflection surface 23a to which the 45 degrees of the direction of a normal were leaned to the direction of an optical axis of a collimator lens 24. Light equipment 25 can carry out outgoing radiation of the light of the coherent linearly polarized light, and semiconductor laser can be used for it.

[0032] As for the photodetector 26 by which the light from a light equipment 25 side has been arranged in the direction reflected by semi-reflection surface 23a of a beam splitter 23, and the photodetector 26 in a beam splitter 23, pickup 11 equips the opposite side with the convex lens 27, the cylindrical lens 28, and the quadrisection photodetector 29 which have been arranged sequentially from a beam splitter 23 side further. A photodetector 26 receives the light from light equipment 25, and in order that the output may carry out regulating automatically of the output of light equipment 25, it is used. The quadrisection photodetector 29 has four light sensing portions 29a-29d divided by parting line 30b of the direction which intersects perpendicularly with parting line 30a and this parallel to a direction corresponding to the direction of a truck in the optical information record medium 1, as shown in drawing 3 . The cylindrical lens 28 is arranged so that the medial axis of the cylinder side may make 45 degrees to the parting lines 30a and 30b of the quadrisection photodetector 29.

[0033] In addition, the phase space optical modulator 17, the space optical modulator 18, and light equipment 25 in pickup 11 are controlled by the controller 90 in drawing 2 . The controller 90 holds the information on two or more modulation patterns for modulating the phase of light spatially in the phase space optical modulator 17. Moreover, a control unit 91 can choose the modulation pattern of arbitration now from two or more modulation patterns. And a controller 90 gives the information on the modulation pattern chosen by the modulation pattern or control unit 91 which oneself chose according to predetermined conditions to the phase space optical modulator 17, and the phase space optical modulator 17 modulates the phase of light spatially by the corresponding modulation pattern according to the information on the modulation pattern given from a controller 90.

[0034] Moreover, the reflection factor of each semi-reflection surfaces 15a and 19b in pickup 11 is suitably

set up so that the reinforcement of the information light which carries out incidence to the optical information record medium 1, and the reference beam for record may become equal.
[0035] Drawing 3 is the block diagram showing the configuration of the detector 85 for detecting focal error signal FE, the tracking error signal TE, and a regenerative signal RF based on the output of the quadrisection photodetector 29. The adder 31 with which this detector 85 adds each light sensing portions [of the vertical angle of the quadrisection photodetector 29 / 29a and 29d] output, The adder 32 adding each output of the light sensing portions 29b and 29c of the vertical angle of the quadrisection photodetector 29, The subtractor 33 which calculates the difference of the output of an adder 31, and the output of an adder 32, and generates focal error signal FE by the astigmatism method, The adder 34 adding each output of the light sensing portions 29a and 29b which adjoin each other along the direction of a truck of the quadrisection photodetector 29, The adder 35 adding each light sensing portions [which adjoin each other along the direction of a truck of the quadrisection photodetector 29 / 29c and 29d] output, The difference of the output of an adder 34 and the output of an adder 35 was calculated, and it has the adder 37 which adds the subtractor 36 which generates the tracking error signal TE by the push pull method, and the output of an adder 34 and the output of an adder 35, and generates a regenerative signal RF. In addition, with the gestalt of this operation, a regenerative signal RF is a signal which reproduced the information recorded on the address servo area 6 in the optical information record medium 1.
[0036] Next, at the time of a servo, at the time of record, it divides at the time of playback and an operation of the optical information record regenerative apparatus concerning the gestalt of this operation is explained in order. In addition, at the time of a servo, at the time of record, it is controlled to maintain a regular rotational frequency also at the time of any at the time of playback, and the optical information record medium 1 rotates it with a spindle motor 82.
[0037] First, the operation at the time of a servo is explained with reference to drawing 4 . At the time of a servo, it changes all the pixels of the space optical modulator 18 into a transparency condition. The output of the outgoing radiation light of light equipment 25 is set as the low-power output for playback. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of an objective lens 12 passes through the address servo area 6 is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of an objective lens 12 passes through the address servo area 6.
[0038] Light by which outgoing radiation was carried out from light equipment 25 is made the parallel flux of light by the collimator lens 24, and carries out incidence to a beam splitter 23, a part of quantity of light is penetrated by semi-reflection surface 23a, and a part is reflected. The light reflected by semi-reflection surface 23a is received by the photodetector 26. Incidence of the light which penetrated semi-reflection surface 23a is carried out to the prism block 19, and a part of quantity of light penetrates semi-reflection surface 19b. The space optical modulator 18 is passed, it is reflected by reflector 15b of the prism block 15, and a part of quantity of light penetrates semi-reflection surface 15a, and also 2 division rotatory-polarization plate 14 is passed, and it is condensed with an objective lens 12, and the light which penetrated semi-reflection surface 19b is irradiated by the information record medium 1 so that it may converge on the interface of the hologram layer 3 in the optical information record medium 1, and a protective layer 4. It is reflected by the reflective film 5 of the optical information record medium 1, and in that case, the embossing pit in the address servo area 6 becomes irregular, and this light returns to an objective lens 12 side.
[0039] Return light from the optical information record medium 1 is made into the parallel flux of light with an objective lens 12, 2 division rotatory-polarization plate 14 is passed again, incidence is carried out to the prism block 15, and a part of quantity of light penetrates semi-reflection surface 15a. It is reflected by reflector 15a, the return light which penetrated semi-reflection surface 15a passes the space optical modulator 18, and a part of quantity of light penetrates semi-reflection surface 19b of the prism block 19. After carrying out incidence to a beam splitter 23, reflecting a part of quantity of light by semi-reflection surface 23a and the return light which penetrated semi-reflection surface 19b passing a convex lens 27 and a cylindrical lens 28 in order, it is detected by the quadrisection photodetector 29. And while focal error signal FE, the tracking error signal TE, and a regenerative signal RF are generated by the detector 85 shown in drawing 3 and a focus servo and a tracking servo are performed based on these signals based on the output of this quadrisection photodetector 29, playback of a basic clock and distinction of the address are performed.
[0040] In addition, in a setup at the time of the above-mentioned servo, the configuration of pickup 11 becomes being the same as that of the configuration of pickup of for [to the usual optical disks, such as CD (compact disc), DVD (a digital video disc or digital versatile disk), and HS (hyper-storage disk), / record

and for playback]. Therefore, it is also possible to constitute from an optical information record regenerative apparatus 10 in the gestalt of this operation so that compatibility with the usual optical disk unit may be given.

[0041] Here, A polarization and B polarization which are used by next explanation are defined as follows. That is, as shown in drawing 10 , A polarization is made into the linearly polarized light which rotated [S polarization] the +45-degree polarization direction for -45 degrees or P polarization, and B polarization makes S polarization the linearly polarized light which rotated the -45-degree polarization direction for +45 degrees or P polarization. As for A polarization and B polarization, the polarization direction lies at right angles mutually. In addition, S polarization is the linearly polarized light with the polarization direction perpendicular to plane of incidence (space of drawing 1), and P polarization is the linearly polarized light with the polarization direction parallel to plane of incidence.

[0042] Next, the operation at the time of record is explained. Drawing 6 is the explanatory view showing the condition of the pickup 11 at the time of record. At the time of record, the space optical modulator 18 chooses a transparency condition (henceforth ON), and a cut off state (henceforth OFF) for every pixel according to the information to record, modulates the passing light spatially and generates information light. With the gestalt of this operation, 1-bit information is expressed by 2 pixels, one side of the 2 pixels corresponding to 1-bit information is turned on, and another side is surely made off.

[0043] Moreover, the phase space optical modulator 17 generates the reference beam for record which modulates the phase of light spatially and by which the phase of light was modulated spatially to the passing light by giving phase contrast 0 (rad) or pi (rad) alternatively on the basis of a predetermined phase for every pixel according to a predetermined modulation pattern. A controller 90 gives the information on the modulation pattern chosen by the modulation pattern or control unit 91 which oneself chose according to predetermined conditions to the phase space optical modulator 17, and the phase space optical modulator 17 modulates the phase of the passing light spatially according to the information on the modulation pattern given from a controller 90.

[0044] The output of the outgoing radiation light of light equipment 25 is made into the high power for record in pulse. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of an objective lens 12 passes a data area 7 is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of an objective lens 12 passes a data area 7. While the outgoing radiation light of an objective lens 12 passes a data area 7, a focus servo and a tracking servo are not performed, but the objective lens 12 is being fixed. Moreover, in the following explanation, light equipment 25 shall carry out outgoing radiation of the light of P polarization.

[0045] As shown in drawing 6 , by the collimator lens 24, light of P polarization by which outgoing radiation was carried out from light equipment 25 is made into the parallel flux of light, and carries out incidence to a beam splitter 23, a part of quantity of light penetrates semi-reflection surface 23a, and it carries out incidence of it to the prism block 19. As for the light which carried out incidence to the prism block 19, a part of quantity of light penetrates semi-reflection surface 19b, and a part of quantity of light is reflected by semi-reflection surface 19b. The space optical modulator 18 is passed, it becomes irregular spatially according to the information recorded in that case, and the light which penetrated semi-reflection surface 19b turns into information light. It is reflected by reflector 15b of the prism block 15, a part of quantity of light penetrates semi-reflection surface 15a, and this information light passes 2 division rotatory-polarization plate 14. Here, the polarization direction rotates +45 degrees of light which passed rotatory-polarization plate 14L of 2 division rotatory-polarization plate 14, and it becomes the light of A polarization, and the polarization direction rotates -45 degrees of light which passed rotatory-polarization plate 14R, and it becomes the light of B polarization. It is condensed with an objective lens 12, and the information light which passed 2 division rotatory-polarization plate 14 is irradiated by the optical information record medium 1 so that it may converge on the interface 5 of the hologram layer 3 in the optical information record medium 1, and a protective layer 4, i.e., the reflective film.

[0046] On the other hand, it is reflected by reflector 19a and the light reflected by semi-reflection surface 19b of the prism block 19 passes the phase space optical modulator 17, and in that case, according to a predetermined modulation pattern, the phase of light is modulated spatially and it turns into a reference beam for record. This reference beam for record turns into light which passes a convex lens 16 and is converged. A part of quantity of light is reflected by semi-reflection surface 15a of the prism block 15, and this reference beam for record passes 2 division rotatory-polarization plate 14. Here, the polarization direction rotates +45 degrees of light which passed rotatory-polarization plate 14L of 2 division rotatory-polarization plate 14, and it becomes the light of A polarization, and the polarization direction rotates -45

degrees of light which passed rotatory-polarization plate 14R, and it becomes the light of B polarization. It is condensed with an objective lens 12 and the reference beam for record which passed 2 division rotatory-polarization plate 14 is irradiated by the optical information record medium 1, and after converging so that it may once become a minor diameter from the interface of the hologram layer 3 and a protective layer 4 most by the near side, it passes the hologram layer 3, emitting.

[0047] Drawing 7 and drawing 8 are the explanatory views showing the condition of the light at the time of record. In addition, in these drawings, the notation shown with the sign 61 expresses P polarization, the notation shown with the sign 63 expresses A polarization, and the notation shown with the sign 64 expresses B polarization.

[0048] As shown in drawing 7 , it becomes the light of A polarization, the optical information record medium 1 irradiates through an objective lens 12, and the hologram layer 3 is passed, and while converging so that it may become a minor diameter most on the reflective film 5, it is reflected by the reflective film 5, and information light 51L which passed rotatory-polarization plate 14L of 2 division rotatory-polarization plate 14 passes a hologram 3 again. Moreover, reference beam 52L for record which passed rotatory-polarization plate 14L of 2 division rotatory-polarization plate 14 becomes the light of A polarization, is irradiated by the information record medium 1 through an objective lens 12, and after converging so that it may once become a minor diameter from the interface of the hologram layer 3 and a protective layer 4 most by the near side, it passes the hologram layer 3, emitting. And when information light 51L of A polarization reflected by the reflective film 5 in the hologram layer 3 and reference beam 52L for record of A polarization which progresses to the reflective film 5 side interfere, an interference pattern is formed and the output of the outgoing radiation light of light equipment 20 turns into high power, the interference pattern is recorded in volume in the hologram layer 3.

[0049] Moreover, as shown in drawing 8 , it becomes the light of B polarization, the information record medium 1 irradiates through an objective lens 12, and the hologram layer 3 is passed, and while converging so that it may become a minor diameter most on the reflective film 5, it is reflected by the reflective film 5, and information light 51R which passed rotatory-polarization plate 14R of 2 division rotatory-polarization plate 14 passes a hologram 3 again. Moreover, reference beam 52R for record which passed rotatory-polarization plate 14R of 2 division rotatory-polarization plate 14 becomes the light of B polarization, is irradiated by the information record medium 1 through an objective lens 12, and after converging so that it may once become a minor diameter from the interface of the hologram layer 3 and a protective layer 4 most by the near side, it passes the hologram layer 3, emitting. And when information light 51R of B polarization reflected by the reflective film 5 in the hologram layer 3 and reference beam 52R for record of B polarization which progresses to the reflective film 5 side interfere, an interference pattern is formed and the output of the outgoing radiation light of light equipment 20 turns into high power, the interference pattern is recorded in volume in the hologram layer 3.

[0050] As shown in drawing 7 and drawing 8 , with the gestalt of this operation, information light and the reference beam for record are irradiated from the same field side to the hologram layer 3 so that the optical axis of information light and the optical axis of the reference beam for record may be arranged on the same line.

[0051] It is possible to carry out multiplex record of the information by phase-encoding multiplex in the same part of the hologram layer 3 by changing the modulation pattern of the reference beam for record, and performing record actuation of multiple times in the same part of the hologram layer 3, with the gestalt of this operation.

[0052] Thus, with the gestalt of this operation, the hologram of a reflective mold (Lippmann mold) is formed in the hologram layer 3. In addition, since the polarization direction intersects perpendicularly, it does not interfere in information light 51L of A polarization, and reference beam 52R for record of B polarization, and similarly, since the polarization direction intersects perpendicularly, they do not interfere in information light 51R of B polarization, and reference beam 52L for record of A polarization. Thus, with the gestalt of this operation, generating of an excessive interference fringe is prevented and the fall of SN (signal-to-noise) ratio can be prevented.

[0053] Moreover, with the gestalt of this operation, it irradiates so that it may become a minor diameter most on the interface of the hologram layer 3 in the optical information record medium 1, and a protective layer 4 and may converge as mentioned above, and it is reflected by the reflective film 5 of the information record medium 1, and information light returns to an objective lens 12 side. Incidence of this return light is carried out to the quadrisection photodetector 29 like the time of a servo. Therefore, it is possible to perform a focus servo with the gestalt of this operation using the light which carries out incidence to this

quadrisection photodetector 29 also at the time of record. In addition, since it converges so that it may become a minor diameter from the interface of the hologram layer 3 in the optical information record medium 1, and a protective layer 4 most by the near side, and the reference beam for record turns into emission light, even if it is reflected by the reflective film 5 of the information record medium 1 and it returns to an objective lens 12 side, image formation of it is not carried out on the quadrisection photodetector 29.

[0054] In addition, it is possible to decide the magnitude of the field (hologram) where one interference pattern by information light and the reference beam is recorded in volume in the hologram layer 3 by moving a convex lens 16 forward and backward, or changing the scale factor with the gestalt of this operation to be arbitration.

[0055] Next, the operation at the time of playback is explained with reference to drawing 9 . At the time of playback, all the pixels of the space optical modulator 18 are turned ON. Moreover, a controller 90 gives the information on the modulation pattern of the reference beam for record at the time of record of the information which it is going to reproduce to the phase space optical modulator 17, and generates the reference beam for playback by which the phase space optical modulator 17 modulated the phase of the passing light spatially according to the information on the modulation pattern given from a controller 90, and the phase of light was modulated spatially.

[0056] The output of the outgoing radiation light of light equipment 25 is made into the low-power output for playback. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of an objective lens 12 passes a data area 7 is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of an objective lens 12 passes a data area 7. While the outgoing radiation light of an objective lens 12 passes a data area 7, a focus servo and a tracking servo are not performed, but the objective lens 12 is being fixed.

[0057] As shown in drawing 9 , by the collimator lens 24, light of P polarization by which outgoing radiation was carried out from light equipment 25 is made into the parallel flux of light, and carries out incidence to a beam splitter 23, a part of quantity of light penetrates semi-reflection surface 23a, and it carries out incidence of it to the prism block 19. As for the light which carried out incidence to the prism block 19, a part of quantity of light is reflected by semi-reflection surface 19b, it is reflected by reflector 19a and this reflected light passes the phase space optical modulator 17, and in that case, according to a predetermined modulation pattern, the phase of light is modulated spatially and it turns into a reference beam for playback. This reference beam for playback turns into light which passes a convex lens 16 and is converged. A part of quantity of light is reflected by semi-reflection surface 15a of the prism block 15, and this reference beam for playback passes 2 division rotatory-polarization plate 14. Here, the polarization direction rotates +45 degrees of light which passed rotatory-polarization plate 14L of 2 division rotatory-polarization plate 14, and it becomes the light of A polarization, and the polarization direction rotates -45 degrees of light which passed rotatory-polarization plate 14R, and it becomes the light of B polarization. It is condensed with an objective lens 12 and the reference beam for playback which passed 2 division rotatory-polarization plate 14 is irradiated by the optical information record medium 1, and after converging so that it may once become a minor diameter from the interface of the hologram layer 3 and a protective layer 4 most by the near side, it passes the hologram layer 3, emitting.

[0058] Drawing 10 and drawing 11 are the explanatory views showing the condition of the light at the time of playback. In addition, in these drawings, the notation shown with the sign 61 expresses P polarization, the notation shown with the sign 62 expresses S polarization, the notation shown with the sign 63 expresses A polarization, and the notation shown with the sign 64 expresses B polarization.

[0059] As shown in drawing 10 , reference beam 53L for playback which passed rotatory-polarization plate 14L of 2 division rotatory-polarization plate 14 becomes the light of A polarization, the optical information record medium 1 irradiates through an objective lens 12, and after converging so that it may once become a minor diameter from the interface of the hologram layer 3 and a protective layer 4 most by the near side, the hologram layer 3 is passed, emitting. Consequently, playback light 54L corresponding to information light 51L at the time of record occurs from the hologram layer 3. This playback light 54L progresses to an objective lens 12 side, is made into the parallel flux of light with an objective lens 12, passes 2 division rotatory-polarization plate 14 again, and becomes the light of S polarization.

[0060] Moreover, as shown in drawing 11 , reference beam 53R for playback which passed rotatory-polarization plate 14R of 2 division rotatory-polarization plate 14 becomes the light of B polarization, the optical information record medium 1 irradiates through an objective lens 12, and after converging so that it may once become a minor diameter from the interface of the hologram layer 3 and a protective layer 4 most

by the near side, the hologram layer 3 is passed, emitting. Consequently, playback light 54R corresponding to information light 51R at the time of record occurs from the hologram layer 3. This playback light 54R progresses to an objective lens 12 side, is made into the parallel flux of light with an objective lens 12, passes 2 division rotatory-polarization plate 14 again, and becomes the light of S polarization.

[0061] Incidence of the playback light which passed 2 division rotatory-polarization plate 14 is carried out to the prism block 15, and a part of quantity of light penetrates semi-reflection surface 15a. It is reflected by reflector 15a, and the space optical modulator 18 is passed, a part of quantity of light is reflected by semi-reflection surface 19b of the prism block 19, and incidence of the playback light which penetrated semi-reflection surface 15a is carried out to the CCD array 20, and it is detected by the CCD array 20. On the CCD array 20, image formation of the pattern of ON by the space optical modulator 18 at the time of record and OFF is carried out, and information is reproduced by detecting this pattern.

[0062] In addition, when the modulation pattern of the reference beam for record is changed and multiplex record of two or more information is carried out at the hologram layer 3, only the information corresponding to the reference beam for record of the modulation pattern same among two or more information as the modulation pattern of the reference beam for playback is reproduced.

[0063] As shown in drawing 10 and drawing 11 , with the gestalt of this operation, exposure of the reference beam for playback and collection of playback light are performed from the same field side of the hologram layer 3 so that the optical axis of the reference beam for playback and the optical axis of playback light may be arranged on the same line.

[0064] Moreover, with the gestalt of this operation, incidence of a part of playback light is carried out to the quadrisection photodetector 29 like the return light at the time of a servo. Therefore, it is possible to perform a focus servo with the gestalt of this operation using the light which carries out incidence to this quadrisection photodetector 29 also at the time of playback. In addition, since it converges so that it may become a minor diameter from the interface of the hologram layer 3 in the optical information record medium 1, and a protective layer 4 most by the near side, and the reference beam for playback turns into emission light, even if it is reflected by the reflective film 5 of the optical information record medium 1 and it returns to an objective lens 12 side, image formation of it is not carried out on the quadrisection photodetector 29.

[0065] By the way, when detecting the two-dimensional pattern of playback light, it is necessary to position playback light and the CCD array 20 correctly, or to recognize the criteria location in the pattern of playback light from the detection data of the CCD array 20 by the CCD array 20. The latter is adopted with the gestalt of this operation. Here, with reference to drawing 12 and drawing 13 , how to recognize the criteria location in the pattern of playback light from the detection data of the CCD array 20 is explained. As shown in drawing 12 (a), the aperture in pickup 11 is divided into two fields 71L and 71R symmetrical as a core in an optical axis with 2 division rotatory-polarization plate 14. Furthermore, as shown in drawing 12 (b), aperture is divided into two or more pixels 72 by the space optical modulator 18. This pixel 72 serves as a smallest unit of two-dimensional pattern data. With the gestalt of this operation, 1-bit digital data "0" or "1" is expressed by 2 pixels, one side of the 2 pixels corresponding to 1-bit information is turned on, and another side is made off. In when [both / ON or when it is both OFF], 2 pixels becomes error data. Thus, expressing 1-bit digital data by 2 pixels has the merit of being able to raise the detection precision of data by differential detection. Drawing 13 (a) expresses the 2-pixel group 73 corresponding to 1-bit digital data. The field where this group 73 exists is hereafter called data area. He is trying to include the criteria positional information which shows the criteria location in the pattern of playback light in information light with the gestalt of this operation using 2 pixels becoming error data in when [both / ON or when it is both OFF]. That is, as shown in drawing 13 (b), error data are intentionally arranged by the predetermined pattern to the field 74 of a cross which consists of a part with an parallel to the parting line of 2 division rotatory-polarization plate 14 width of face of 2 pixels, and a part with a perpendicular to a parting line width of face of 2 pixels. The pattern of these error data is hereafter called pixel pattern for tracking. This pixel pattern for tracking serves as criteria positional information. In addition, in drawing 13 (b), a sign 75 expresses the pixel of ON and the sign 76 expresses the pixel of OFF. Moreover, the 4-pixel field 77 for a core is always turned OFF.

[0066] If the pixel pattern for tracking and the pattern corresponding to the data to record are set, it will become a two-dimensional pattern as shown in drawing 14 (a). With the gestalt of this operation, while turning OFF the upper half in drawing among fields other than a data area and turning ON a lower half further, if fields other than a condition opposite to fields other than a data area, i.e., a data area, are off and fields other than ON and a data area are ON, suppose that it is off about the pixel which touches fields other

than a data area in a data area. This becomes possible [detecting the boundary part of a data area more clearly] from the detection data of the CCD array 20.
[0067] The interference pattern of the information light and the reference beam for record by which the space modulation was carried out according to the two-dimensional pattern as shown in drawing 14 (a) at the time of record is recorded on the hologram layer 3. As the pattern of the playback light obtained at the time of playback was shown in drawing 14 (b), contrast falls compared with the time of record, and the SN ratio is getting worse. Although the pattern of playback light as shown in drawing 14 (b) is detected and data are distinguished by the CCD array 20 at the time of playback, in that case, the pixel pattern for tracking is recognized and data are distinguished by making the location into a criteria location.
[0068] Drawing 15 (a) expresses notionally the contents of the data distinguished from the pattern of playback light. A-1-1 in drawing etc. -- the data whose field which attached the sign is 1 bit, respectively are expressed. With the gestalt of this operation, it divides into the four fields 78A, 78B, 78C, and 78D by dividing a data area in the field 74 of a cross in which the pixel pattern for tracking was recorded. And the diagonal fields 78A and 78C are doubled, a rectangular field is formed, the diagonal fields 78B and 78D are doubled similarly, and he forms a rectangular field, and is trying to form an ECC table by arranging the field of two rectangles up and down, as shown in drawing 15 (b). An ECC table is a table of the data which added and formed error correction codes (ECC), such as the CRC (cyclic redundancy check) code, in the data which should be recorded. In addition, drawing 15 (b) can show an example of the ECC table of a n line m train, and can also design other arrays freely. Moreover, the part which the data array shown in drawing 15 (a) uses the part of the ECC tables shown in drawing 15 (b), and is not used for the data array shown in drawing 15 (a) among the ECC tables shown in drawing 15 (b) is not concerned with the contents of data, but let it be a fixed value. At the time of record, decompose into four fields 78A, 78B, 78C, and 78D, and an ECC table as shown in drawing 15 (b) is recorded on the optical information record medium 1, as shown in drawing 15 (a). At the time of playback, the data of an array as shown in drawing 15 (a) are detected, an ECC table as rearranged this and shown in drawing 15 (b) is reproduced, an error correction is performed based on this ECC table, and data are reproduced.
[0069] Recognition of the criteria location (pixel pattern for tracking) in the pattern of the above playback light and an error correction are performed by the digital disposal circuit 89 in drawing 2 .
[0070] As explained above, according to the optical information record regenerative apparatus 10 concerning the gestalt of this operation Enabling multiplex record of information by phase-encoding multiplex to the optical information record medium 1 The exposure of the reference beam for record to the optical information record medium 1 at the time of record, and information light, Since it was made to perform exposure of the reference beam for record to the optical information record medium 1 at the time of playback, and collection of playback light on the same shaft from the same field side to the optical information record medium 1 altogether Compared with the conventional holographic recording method, the optical system for record or playback can be constituted small, and the problem of the stray light like [in the case of being the conventional holographic recording method] does not arise. Moreover, according to the gestalt of this operation, the optical system for record and playback can consist of forms of the same pickup 11 as the usual optical disk unit. Therefore, random access to the optical information record medium 1 can be performed easily.
[0071] Moreover, since the information for performing a focus servo and a tracking servo is recorded on the optical information record medium 1 and it enabled it to perform a focus servo and a tracking servo using this information according to the gestalt of this operation, while being able to position light for record or playback with a sufficient precision, consequently a remover kinky thread tee's being good and random access's becoming easy, recording density, storage capacity, and a transfer rate can be enlarged. By record of this operation, it becomes possible especially to increase recording density, storage capacity, and a transfer rate by leaps and bounds conjointly with multiplex record of the information by phase-encoding multiplex being possible. For example, when the multiplex record of a series of information is made to be carried out in the same part of the hologram layer 3, changing the modulation pattern of the reference beam for record, it becomes possible to perform informational record and playback at a high speed extremely.
[0072] Moreover, according to the gestalt of this operation, since it is unreproducible if the reference beam for playback of the same modulation pattern as the modulation pattern of the reference beam for record at the time of record of the information is not used for the information recorded on the optical information record medium 1, a copy protection and a security protection are easily realizable. Moreover, according to the gestalt of this operation, the information (for example, various kinds of software) on varieties that the modulation patterns of a reference beam differ is recorded on the optical information record medium 1. The

optical information record-medium 1 very thing becomes realizable [service of providing for a user comparatively cheaply, smelling a user's information on the modulation pattern of the reference beam which responds for asking and makes information on various kinds refreshable, and providing according to an individual for pay as information].
[0073] Moreover, since it was made to include the criteria positional information which shows the criteria location in the pattern of playback light in information light according to the optical information record regenerative apparatus 10 concerning the gestalt of this operation, recognition of the pattern of playback light becomes easy.
[0074] Moreover, since the information recorded on the record medium by the embossing pit by making pickup 11 into the condition at the time of the servo shown in drawing 4 is reproducible according to the optical information record regenerative apparatus 10 concerning the gestalt of this operation, it becomes possible to give compatibility with the conventional optical disk unit.
[0075] Moreover, in order to make the modulation pattern of the phase of a different reference beam correspond in each of the information by which multiplex record is carried out to the optical information record medium 1 according to the optical information record regenerative apparatus 10 concerning the gestalt of this operation, the duplicate of the optical information record medium 1 with which information was recorded is very difficult. Therefore, an illegal duplicate can be prevented.
[0076] Moreover, in the optical information record medium 1 in the gestalt of this operation, since the hologram layer 3 on which information is recorded using holography, and the layer on which the information on the address etc. is recorded by the embossing pit are separated, if it is going to reproduce the optical information record medium 1 with which information was recorded, these two layers must be made to correspond, a duplicate is difficult also from this point and an illegal duplicate can be prevented.
[0077] Next, the optical information record regenerative apparatus concerning the gestalt of operation of the 2nd of this invention is explained. The gestalt of this operation is the example which made it possible to use together phase-encoding multiplex and hole burning mold wavelength multiplexing, and to perform multiplex record. The configuration of the optical whole information record regenerative apparatus concerning the gestalt of this operation is the same as that of the abbreviation for the configuration of the optical information record regenerative apparatus 10 concerning the gestalt of the 1st operation shown in drawing 2 .
[0078] Introduction and hole burning mold wavelength multiplexing are explained briefly. A hole burning means the phenomenon which produces change of the rate of light absorption in the wavelength location of incident light in a light absorption spectrum, and it is also called a photograph chemical hole burning. Hereafter, the ingredient which starts a hole burning, i.e., the ingredient which produces change of the rate of light absorption in the wavelength location of incident light in a light absorption spectrum, is called hole burning ingredient. Generally a hole burning ingredient is an ingredient with which light absorption core (called guest.) ingredients, such as coloring matter, were distributed by the medium (called host.) ingredient with irregular structure of an amorphous substance etc. This hole burning ingredient has a broadcloth light absorption spectrum by the superposition of many guests' light absorption spectrum under very low temperature. Into such a hole burning ingredient, if the light of specific wavelength (however, wavelength in the light absorption band of a hole burning ingredient), such as a laser beam, is irradiated, in order that only the guest who has a resonance spectrum corresponding to the wavelength may move to the energy level which changes with photochemical reactions, reduction of the rate of light absorption arises in the wavelength location of light irradiated in the light absorption spectrum of a hole burning ingredient.
[0079] Drawing 16 expresses the condition that reduction of the rate of light absorption arose in two or more wavelength locations, by the exposure of the light of two or more wavelength in the light absorption spectrum of a hole burning ingredient. In a hole burning ingredient, the part into which the rate of light absorption decreased by the exposure of light is called a hole. Since this hole is very small, it becomes possible to change wavelength into a hole burning ingredient and to carry out multiplex record of two or more information, and the approach of such multiplex record is called hole burning mold wavelength multiplexing. Since a hole is the magnitude of about 10 - 2nm, with the hole burning ingredient, it is thought that about 103 to 104 multiplicity is obtained. In addition, the detailed explanation about a hole burning is indicated by "the Corona Publishing issue "the foundation of optical memory", 104 -133 Paige, 1990", and the above-mentioned reference "research of real-time new record playback of the wavelength multiplexing mold hologram using PHB."
[0080] Wavelength is changed and it enables it to form two or more holograms to a hole burning ingredient in this example using above-mentioned hole burning mold wavelength multiplexing. Therefore, in the

optical information record medium 1 used with the optical information record regenerative apparatus concerning the gestalt of this operation, the hologram layer 3 is formed with the above-mentioned hole burning ingredient.

[0081] Moreover, in this example, the light equipment 25 in pickup 11 makes alternatively light with two or more coherent wavelength which can be set in the light absorption band of the hole burning ingredient which forms the hologram layer 3 the thing in which outgoing radiation is possible. The tunable laser equipment which has the wavelength selection components (prism, diffraction grating, etc.) which choose the wavelength of the outgoing radiation light of dye laser and this dye laser as such light equipment 25, the tunable laser equipment which has a wavelength sensing element using the nonlinear optical element which changes the wavelength of the outgoing radiation light of laser and this laser can be used.

[0082] In the gestalt of this operation, like the gestalt of the 1st operation, a control unit 91 can choose the wavelength of the outgoing radiation light of light equipment 25 from two or more selectable wavelength while being able to choose the modulation pattern of a reference beam from two or more modulation patterns. And a controller 90 gives the information on the wavelength chosen by the wavelength which oneself chose according to predetermined conditions, or the control unit 91 to light equipment 25, and light equipment 25 carries out outgoing radiation of the corresponding light of wavelength according to the information on the wavelength given from a controller 90.

[0083] The configuration of others of the optical information record regenerative apparatus concerning this example is the same as that of the gestalt of the 1st operation.

[0084] In the optical information record regenerative apparatus concerning this example, the wavelength of the outgoing radiation light of light equipment 25 is chosen from two or more selectable wavelength at the time of record. Thereby, a selected information light and the selected reference beam for record of wavelength are generated. At this example, hole burning mold wavelength multiplexing can perform multiplex record in the same part of the hologram layer 3 by changing the wavelength of information light and the reference beam for record, and performing record actuation of multiple times.

[0085] Moreover, in the same part of the hologram layer 3, on a certain wavelength, the modulation pattern of the reference beam for record is changed, record actuation of multiple times is performed, phase-encoding multiplex and hole burning mold wavelength multiplexing can be used together, and multiplex record can be performed in the optical information record regenerative apparatus concerning this example by changing the modulation pattern of the reference beam for record similarly on the wavelength of further others, and performing record actuation of multiple times. In this case, the multiplicity of NxM will be obtained when the multiplicity according the multiplicity by phase-encoding multiplex to N and hole burning mold wavelength multiplexing is set to M. Therefore, according to this example, compared with the gestalt of the 1st operation, it becomes possible to increase more recording density, storage capacity, and a transfer rate.

[0086] Moreover, according to this example, since it is unreproducible if the reference beam for playback of the same wavelength as the wavelength of the information light at the time of record of the information and the reference beam for record is not used for the information recorded on the optical information record medium 1, a copy protection and a security protection are easily realizable like the gestalt of the 1st operation. Furthermore, when phase-encoding multiplex and hole burning mold wavelength multiplexing are used together and multiplex record is performed, it is the same wavelength as the wavelength of the information light at the time of record of the information, and the reference beam for record, and since it is unreproducible if the reference beam for playback of the same modulation pattern as the modulation pattern of the reference beam for record is not used, it becomes possible to realize a copy protection and a security protection more firmly.

[0087] Moreover, according to the gestalt of this operation, the information on varieties that the wavelength of information light and the reference beam for record differs from the modulation pattern of a reference beam is recorded on the optical information record medium 1. The optical information record-medium 1 very thing becomes realizable [service of providing for a user comparatively cheaply, smelling the information on a user's wavelength of the reference beam which responds for asking and makes information on various kinds refreshable and modulation pattern, and providing according to an individual for pay as information].

[0088] The other operations and effectiveness in the gestalt of this operation are the same as the gestalt of the 1st operation.

[0089] Next, the optical information record regenerative apparatus concerning the gestalt of operation of the 3rd of this invention is explained. The configuration of the optical whole information record regenerative

apparatus concerning the gestalt of this operation is the same as that of the abbreviation for the configuration of the optical information record regenerative apparatus 10 concerning the gestalt of the 1st operation shown in drawing 2 . However, the configuration of pickup differs from the gestalt of the 1st operation.
[0090] The explanatory view showing the configuration of pickup [in / in drawing 17 / the gestalt of this operation] and drawing 18 are the top views showing the configuration of the optical unit containing each element which constitutes pickup.
[0091] The pickup 111 in the gestalt of this operation equips the travelling direction of the light by which outgoing radiation is carried out from the light equipment 112 which carries out outgoing radiation of the laser beam of the coherent linearly polarized light, and this light equipment 112 with the collimator lens 113 arranged in order [side / light equipment 112], the middle concentration filter (it is described as an ND filter below neutral density filter;.) 114, the optical element 115 for rotatory polarization, the polarization beam splitter 116, the phase space optical modulator 117, the beam splitter 118, and the photodetector 119. Light equipment 112 carries out outgoing radiation of the light of the linearly polarized light of S polarization or P polarization. A collimator lens 113 makes outgoing radiation light of light equipment 112 the parallel flux of light, and carries out outgoing radiation. ND filter 114 is the property which equalizes outgoing radiation luminous-intensity distribution of a collimator lens 113. The optical element 115 for rotatory polarization carries out the rotatory polarization of the outgoing radiation light of ND filter 114, and carries out outgoing radiation of the light containing S polarization component and P polarization component. As an optical element 115 for rotatory polarization, 1/2 wavelength plate or a rotatory-polarization plate is used, for example. A polarization beam splitter 116 reflects S polarization component among the outgoing radiation light of the optical element 115 for rotatory polarization, and has polarization beam splitter side 116a which makes P polarization component penetrate. The phase space optical modulator 117 is the same as the phase space optical modulator 17 in the gestalt of the 1st operation. The beam splitter 118 has beam splitter side 118a. This beam splitter side 118a makes for example, P polarization component penetrate 20%, and is reflected 80%. A photodetector 119 supervises the quantity of light of a reference beam, and it is used in order to perform automatic quantity of light adjustment (it is described as APC below auto power control;.) of a reference beam. The light sensing portion may be divided into two or more fields so that this photodetector 119 can also adjust the intensity distribution of a reference beam.
[0092] Pickup 111 is equipped with the polarization beam splitter 120, 2 division rotatory-polarization plate 121, and the starting mirror 122 which have been arranged in order [side / beam splitter 118] in the direction in which the light from light equipment 112 advances further by being reflected by beam splitter side 118a of a beam splitter 118. A polarization beam splitter 120 reflects S polarization component among incident light, and has polarization beam splitter side 120a which makes P polarization component penetrate. 2 division rotatory-polarization plate 121 has rotatory-polarization plate 121R arranged in drawing 17 at the right-hand side part of an optical axis, and rotatory-polarization plate 121L arranged at the left-hand side part of an optical axis. The rotatory-polarization plates 121R and 121L are the same as the rotatory-polarization plates 14R and 14L of 2 division rotatory-polarization plate 14 in the gestalt of the 1st operation, rotatory-polarization plate 121R rotates the -45 degrees of the polarization directions, and rotatory-polarization plate 121L rotates the +45 degrees of the polarization directions. The starting mirror 122 is leaned to 45 degrees to the optical axis of the light from 2 division rotatory-polarization plate 121, and has the reflector in which the light from 2 division rotatory-polarization plate 121 is reflected towards the direction which intersects perpendicularly with the space in drawing 17 .
[0093] Pickup 111 is equipped with the movable actuator 124 (refer to drawing 18) in the thickness direction and the direction of a truck of the optical information record medium 1 for the objective lens 123 which counters the transparence substrate 2 side of the optical information record medium 1, and this objective lens 123, when the light from 2 division rotatory-polarization plate 121 rises, it has been further arranged in the direction which reflects and advances in the reflector of a mirror 122 and the optical information record medium 1 is fixed to a spindle 81.
[0094] Pickup 111 is equipped with the space optical modulator 125 arranged in order [side / polarization beam splitter 116], the convex lens 126, the beam splitter 127, and the photodetector 128 in the direction in which the light from light equipment 112 advances further by being reflected by polarization beam splitter side 116a of a polarization beam splitter 116. The space optical modulator 125 is the same as the space optical modulator 18 in the gestalt of the 1st operation. In the optical information record medium 1, a convex lens 126 completes information light by the near side from the reference beam for record, and has the function which forms the interference region of the reference beam for record, and information light.

Moreover, the magnitude of the interference region of the reference beam for record and information light can be adjusted now by adjusting the location of this convex lens 126. The beam splitter 127 has beam splitter side 127a. This beam splitter side 127a makes for example, S polarization component penetrate 20%, and is reflected 80%. A photodetector 128 supervises the quantity of light of information light, and it is used in order to perform APC of information light. The light sensing portion may be divided into two or more fields so that this photodetector 128 can also adjust information luminous-intensity distribution. Incidence of the light which carries out incidence to a beam splitter 127 from a convex lens 126 side, and is reflected by beam splitter side 127a is carried out to a polarization beam splitter 120.

[0095] Pickup 111 equips the opposite side with the convex lens 129, the cylindrical lens 130, and the quadrisection photodetector 131 which have been arranged in order [side / beam splitter 127] in the polarization beam splitter 120 in a beam splitter 127 further. The quadrisection photodetector 131 is the same as that of the quadrisection photodetector 29 in the gestalt of the 1st operation. The cylindrical lens 28 is arranged so that the medial axis of the cylinder side may make 45 degrees to the parting line of the quadrisection photodetector 131.

[0096] Pickup 111 equips the opposite side with the image formation lens 132 and the CCD array 133 which have been arranged in order [side / beam splitter 118] in the polarization beam splitter 120 in a beam splitter 118 further.

[0097] Pickup 111 equips the opposite side with the collimator lens 134 and the light equipment 135 for fixing which have been arranged in order [side / polarization beam splitter 116] in the space optical modulator 125 in a polarization beam splitter 116 further. The light equipment 135 for fixing carries out outgoing radiation of the light for the information recorded on the hologram layer 3 of the optical information record medium 1 being established, for example, the ultraviolet radiation with a wavelength of 266nm. As such light equipment 135 for fixing, a laser light source, the light equipment which carries out wavelength conversion and carries out outgoing radiation of the outgoing radiation light of a laser light source through a nonlinear optics medium are used. A collimator lens 134 makes outgoing radiation light of the light equipment 135 for fixing the parallel flux of light. Moreover, in this example, the light equipment 135 for fixing carries out outgoing radiation of the light of S polarization.

[0098] As shown in drawing 18 , the optical unit 140 is equipped with the optical unit body 141. In addition, drawing 18 shows only a part for the bottom surface part of the optical unit body 141. A collimator lens 113, ND filter 114, the optical element 115 for rotatory polarization, a polarization beam splitter 116, the phase space optical modulator 117, a beam splitter 118, a polarization beam splitter 120, 2 division rotatory-polarization plate 121, the starting mirror 122, the space optical modulator 125, a convex lens 126, a beam splitter 127, a convex lens 129, a cylindrical lens 130, the above-mentioned image formation lens 132, and an above-mentioned collimator lens 134 are attached in the optical unit body 141.

[0099] Drawing 18 shows the example which used 1/2 wavelength plate as an optical element 115 for rotatory polarization. Moreover, in this example, in the optical unit body 141, in order to adjust the ratio of S polarization component and P polarization component in the outgoing radiation light of the optical element 115 for rotatory polarization, the gear 143 for transmitting rotation of the output shaft of a motor 142 and this motor 142 to the optical element 115 for rotatory polarization is formed.

[0100] Drawing 19 shows the example of the optical element 115 for rotatory polarization which used the rotatory-polarization plate. The optical element 115 for rotatory polarization in this example has two wedge-shaped rotatory-polarization plates 115a and 115b which counter mutually. As the variation rate at least of one side of these rotatory-polarization plates 115a and 115b was carried out in the direction of an arrow head in drawing and it was shown in drawing 19 (a) and (b) with the driving gear which is not illustrated, the thickness of the sum total of the rotatory-polarization plates 115a and 115b in the part which laps the rotatory-polarization plates 115a and 115b changes. The angle of rotation of the light which passes the rotatory-polarization plates 115a and 115b changes by this, consequently the ratio of S polarization component and P polarization component in the outgoing radiation light of the optical element 115 for rotatory polarization changes. In addition, as shown in drawing 19 (a), when the thickness of the sum total of the rotatory-polarization plates 115a and 115b is large, an angle of rotation becomes large, and as shown in drawing 19 (b), when the thickness of the sum total of the rotatory-polarization plates 115a and 115b is small, an angle of rotation becomes small.

[0101] The actuator 124 is attached in the top face of the optical unit body 141. It unites with the drive circuit 145 which drives this light equipment 112, and light equipment 112 is attached in the side face of the unit body 141 with this drive circuit 145. It unites with the APC circuit 146 and the photodetector 119 is attached in the side face of the unit body 141 with this APC circuit 146. The APC circuit 146 amplifies the

output of a photodetector 119, and generates the signal APCref used for APC of a reference beam. It unites with the APC circuit 147 and the photodetector 128 is attached in the side face of the unit body 141 with this APC circuit 147. The APC circuit 147 amplifies the output of a photodetector 119, and generates the signal APCobj used for APC of information light. The signals APCref and APCobj from each APC circuit 146,147 are compared, and the drive circuit 148 which drives a motor 142 so that the ratio of S polarization component and P polarization component in the outgoing radiation light of the optical element 115 for rotatory polarization may be in the optimal condition is attached in the side face of the unit body [/ near the motor 142] 141.

[0102] It unites with a detector 85 (refer to drawing 2), and the quadrisection photodetector 131 is attached in the side face of the unit body 141 with this detector 85. It unites with the digital disposal circuit 149 which performs drive of the CCD array 133, processing of the output signal of the CCD array 133, etc., and the CCD array 133 is attached in the side face of the unit body 141 with this digital disposal circuit 149. It unites with the drive circuit 150 which drives this light equipment 135 for fixing, and the light equipment 135 for fixing is attached in the side face of the unit body 141 with this drive circuit 150. The input/output port 151 which outputs and inputs various kinds of signals between the circuit in the optical unit 140 and the outside of the optical unit 140 is further attached in the side face of the unit body 141. The optical fiber flexible cable 152 containing the optical fiber which transmits a signal using light is connected to this input/output port 151.

[0103] Moreover, although not illustrated, the drive circuit which drives the drive circuit and the space optical modulator 125 which drive the phase space optical modulator 117 is attached in the top face of the optical unit body 141.

[0104] Drawing 20 shows an example of the configuration of the pickup 111 when the laser beam of three colors of red (it is hereafter described as R.), green (it is hereafter described as G.), and blue (it is hereafter described as B.) is made into the thing in which outgoing radiation is possible as a light of two or more wavelength regions and the CCD array 133 also makes light equipment 112 what can detect the light of three colors of R, G, and B.

[0105] The light equipment 112 in the example shown in drawing 20 is equipped with the color composition prism 161. This color composition prism 161 is equipped with R light incidence section 162R, G light incidence section 162G, and B light incidence section 162B. The amendment filters 163R, 163G, and 163B are formed in each incidence sections 162R, 162G, and 162B, respectively. Light equipment 112 is equipped with the semiconductor laser (it is hereafter described as LD.) 164R, 164G, and 164B which carries out outgoing radiation of R light, G light, and the B light further, respectively, and the collimator lenses 165R, 165G, and 165B which make light by which outgoing radiation was carried out the parallel flux of light, and carry out incidence to each incidence sections 162R, 162G, and 162B from each LD 164R, 164G, and 164B. From each LD 164R, 164G, and 164B, through collimator lenses 165R, 165G, and 165B and the amendment filters 163R, 163G, and 163B, incidence of R light by which outgoing radiation was carried out, G light, and the B light is carried out to the color composition prism 161, they are compounded by the color composition prism 161, and carry out incidence to ND filter 114. In addition, in the example shown in drawing 20 , the collimator lens 113 in drawing 17 is not formed.

[0106] The CCD array 133 in the example shown in drawing 20 is equipped with the color-separation prism 171. This color-separation prism 171 is equipped with R light outgoing radiation section 172R, G light outgoing radiation section 172G, and B light outgoing radiation section 172B. The amendment filters 173R, 173G, and 173B are formed in each outgoing radiation sections 172R, 172G, and 172B, respectively. The CCD array 133 has been arranged in the location which counters each outgoing radiation sections 172R, 172G, and 172B further, respectively, and is equipped with CCD 174R, 174G, and 174B which picturizes R optical image, G optical image, and B optical image. The light from the image formation lens 132 side is decomposed into R light, G light, and B light by the color-separation prism 171, and incidence of this R light, G light, and the B light is carried out to CCD 174R, 174G, and 174B through the amendment filters 173R, 173G, and 173B, respectively.

[0107] Next, with reference to drawing 21 thru/or drawing 23 , the slide delivery device of the optical unit 140 in the gestalt of this operation is explained. the part which shows a slide delivery device [in / in the top view in which drawing 21 shows a slide delivery device, and drawing 22 / a quiescent state] -- a notching side elevation and drawing 23 show a slide delivery device when an optical unit displaces minutely -- it is a notching side elevation a part.

[0108] Two shafts 181A and 181B by which the slide delivery device has been arranged in parallel along the migration direction of the optical unit 140, Lessons is taken from each shafts 181A and 181B, two are

prepared at a time, and each shafts 181A and 181B are met. The movable bearing 182, It has the flat spring 183 which connects each bearing 182 and the optical unit 140 elastically, and the linear motor 184 for moving the optical unit 140 along with Shafts 181A and 181B.
[0109] The linear motor 184 is equipped with the magnets 187A and 187B fixed so that a coil 185 might be countered at the inner circumference section of the coil 185 connected with the lower limit section of the optical unit 140, two York 186A and 186B of the shape of a frame arranged along the migration direction of the optical unit 140 so that a part may penetrate the inside of a coil 185, and York 186A and 186B.
[0110] Here, an operation of a slide delivery device is explained. If a linear motor 184 is operated, the optical unit 140 will displace. When this variation rate is minute, as shown in drawing 23 , bearing 182 deforms the flat spring 183 between bearing 182 and the optical unit 140, without displacing. If the variation rate of the optical unit 140 crosses the predetermined range, the optical unit 140 will be followed and bearing 182 will also be displaced. According to such a slide delivery device, when the variation rate of the optical unit 140 is minute, bearing 182 does not displace, therefore wear by slipping of bearing 182 can be prevented. Consequently, it becomes possible to drive the optical unit 140 and to perform a tracking servo with a linear motor 184, securing the endurance and dependability of a slide delivery device. In addition, seeking is also performed by the slide delivery device.
[0111] The actuator 124 held the objective lens 123 and is equipped with the body 182 of an actuator of the shape of a pivotable cylindrical shape centering on the shaft 181. Two holes 183 are formed in this body 182 of an actuator in parallel with a shaft 181. The coil 184 for focuses is formed in the periphery section of the body 182 of an actuator. Furthermore, the coil for access within a visual field which is not illustrated is prepared in a part of periphery of this coil 184 for focuses. The actuator 124 is further equipped with the magnet 185 inserted in each hole 183, and the magnet which has been arranged so that the coil for access within a visual field may be countered and which is not illustrated. In the quiescent state of an actuator 124, the objective lens 123 is arranged so that the line which ties the core and shaft 181 of an objective lens 123 may turn to the direction of a truck.
[0112] Next, with reference to drawing 24 thru/or drawing 27 , the approach of positioning (servo) of the reference beam to the data area of the optical information record medium 1 in the gestalt of this operation and information light is explained. The actuator 124 in the gestalt of this operation can move an objective lens 123 now in the thickness direction and the direction of a truck of the optical information record medium 1.
[0113] Drawing 24 (a) - (c) shows the actuation for which an objective lens 123 is moved in the direction of a truck of the optical information record medium 1 with an actuator 124. The actuator 124 is in the condition which showed in (b) in the quiescent state. An actuator 124 changes from the condition (b) Shown to the condition which showed in (a) or (c) by energizing in the coil for access within a visual field which is not illustrated. Thus, the actuation which moves an objective lens 123 in the direction of a truck of the optical information record medium 1 is called access within a visual field in the gestalt of this operation.
[0114] Drawing 25 shows the migration direction by seeking of an objective lens 123, and the direction of access within a visual field. In drawing 25 , a sign 191 expresses the migration direction by seeking of an objective lens 123, and the sign 192 expresses the migration direction by access within a visual field of an objective lens 123. Moreover, a sign 193 expresses the locus of the core of the objective lens 123 at the time of using together migration by seeking, and access within a visual field. In access within a visual field, the about 2mm thing for which the core of an objective lens 123 is moved is possible.
[0115] With the gestalt of this operation, positioning (servo) of a reference beam and information light is performed to the data area of the optical information record medium 1 using access within a visual field. Drawing 26 is an explanatory view for explaining this positioning. The groove 201 is not formed in the data area 7, although the groove 201 is formed in the address servo area 6 for every truck in the optical information record medium 1 in the gestalt of this operation as shown in drawing 26 (a). Moreover, while being used for playback of a clock, the pit train 202 showing which [of the both ends of a data area 7] is adjoined (in the gestalt of this operation, it is called a polarity.) is formed in the edge of the address servo area 6.
[0116] Setting to drawing 26 (b), a sign 203 expresses the locus of the core of the objective lens 123 at the time of record or playback. With the gestalt of this operation, when carrying out multiplex record of the information by phase-encoding multiplex at a data area 7, or in case the information by which multiplex record was carried out is reproduced to a data area 7 As the core of an objective lens 123 was shown in drawing 26 (b), without making it stop within a data area 7 The core of an objective lens 123 is moved using access within a visual field so that it may reciprocate within the section when the core of an objective lens

123 includes a part of data area 7 and address servo area 6 of the both sides. And while reproducing a clock using the pit train 202, a polarity is judged, and in the section 204 in the address servo area 6, a focus servo and a tracking servo are performed using a groove 201. Within the section 205 containing the data area 7 during the section 204,204, a tracking servo is not performed but the condition at the time of section 204 passage is held. It is determined that the location of the clinch in migration of the core of an objective lens 123 will turn into a fixed location based on the reproduced clock. Moreover, information is determined that the location which carries out multiplex record will also turn into a fixed location based on the reproduced clock in a data area 7. In drawing 26 (b), a sign 206 expresses the gate signal which shows the timing of record or playback. The time of high (H) level expresses that it is the timing of record or playback with this gate signal. In order to carry out multiplex record of the information in the fixed part in a data area 7, for example, when a gate signal is high-level, what is necessary is just made to make the output of light equipment 112 into the high power for record alternatively. Moreover, when a gate signal is high-level, it is made to carry out outgoing radiation of the light from light equipment 112, or the CCD array 133 has electronic shutter ability alternatively, in order to reproduce the information by which multiplex record was carried out in the fixed part in a data area 7 for example, and a gate signal is high-level, to use electronic shutter ability and what is necessary is just made to capture an image.

[0117] Even when performing comparatively long time amount, record, and playback in the same part of the optical information record medium 1 by performing positioning of a reference beam and information light by the above approaches, it can prevent that the location which performs record and playback shifts. Moreover, even if the optical information record medium 1 is rotating, record and playback can be performed in the same situation so that rotation of the optical information record medium 1 may be followed, and it becomes possible in the same part of the optical information record medium 1 to perform comparatively long time amount, record, and playback as the optical information record medium 1 is standing it still by performing access within a visual field. Moreover, if the technique of performing positioning of a reference beam and information light using access within a visual field as mentioned above is used, not only the optical disk-like information record medium 1 but when using the optical information record medium of other gestalten, such as the shape of a card, it will become possible to perform positioning of a reference beam and information light easily.

[0118] Drawing 27 uses together migration by seeking, and access within a visual field, and expresses an example of the locus of the core of the objective lens 123 at the time of accessing two or more [in the optical information record medium 1]. In this drawing, the part which the straight line of a lengthwise direction expresses seeking, and a lateral straight line expresses migration in other parts of the direction of a truck, and is reciprocating within the short section expresses the part which is performing record or playback.

[0119] Next, with reference to drawing 28 and drawing 29 , an example of the cartridge which contains the optical information record medium 1 is explained. It is the top view of the cartridge in the condition that drawing 28 opened the top view of a cartridge and drawing 29 opened the shutter. The cartridge 211 in this example has the window part 212 which makes some optical information record media 1 contained inside expose, and the shutter 213 which open and close this window part 212. The shutter 213 is energized in the direction which closes a window part 212, and at the time, as shown in drawing 28 , the window part 212 is closed, but when an optical information record regenerative apparatus is equipped with a cartridge 211, it is usually moved in the direction in which a window part 212 is opened as shown in drawing 29 by the optical information record regenerative apparatus.

[0120] Next, with reference to drawing 30 thru/or drawing 34 , the example of arrangement of the optical unit 140 in the case of forming two or more pickup 111 in one optical information record regenerative apparatus is explained.

[0121] Drawing 30 shows the example which has arranged two optical units 140A and 140B so that one side of the optical information record medium 1 may be countered. Optical unit 140A is the thing of the same gestalt (henceforth A type) as the optical unit 140 shown in drawing 21 . On the other hand, optical unit 140B is the thing of a gestalt (henceforth B type) symmetrical with a field as the optical unit 140 shown in drawing 21 . Two optical units 140A and 140B are arranged in the location which counters the optical information record medium 1 exposed from the window part 212 of a cartridge 211. Moreover, the slide delivery device of each optical units 140A and 140B is arranged so that the core of the objective lens 123 of each optical units 140A and 140B may move along with the line passing through the core of the optical information record medium 1, respectively.

[0122] Drawing 31 arranges two optical units, respectively so that each side of the optical information

record medium 1 may be countered, and it shows the example which prepared a total of four optical units. Drawing 32 is the A-A' line sectional view of drawing 31 , and drawing 33 is the B-B' line sectional view of drawing 31 . In this example, two optical units 140A and 140B are arranged, and two optical units 140C and 140D are arranged so that the field (front face in drawing 31) of another side of the optical information record medium 1 may be countered, so that one field (rear face in drawing 31) of the optical information record medium 1 may be countered. Optical unit 140C is an A type thing, and optical unit 140D is a B type thing.

[0123] The conditions of arrangement of the optical units 140A and 140B and the slide delivery device of those and arrangement of the optical units 140C and 140D and the slide delivery device of those are as having explained using drawing 30 . In addition, in order to use effectively four optical units 140A, 140B, 140C, and 140D, it is necessary to use the thing in which record of the information from both sides and playback are possible as an optical information record medium 1.

[0124] Drawing 34 arranges eight optical units, respectively so that each field of the optical information record medium 1 may be countered, and it shows the example which prepared a total of 16 optical units. In this example, eight optical units 1401-1408 are arranged, and eight optical units 1409-14016 are arranged so that the field (rear face in drawing 34) of another side of the optical information record medium 1 may be countered, so that one field (front face in drawing 34) of the optical information record medium 1 may be countered. The optical units 1401, 1403, 1405, 1407, 14010, 14012, 14014, and 14016 are A type things. The optical units 1402, 1404, 1406, 1408, 1409, 14011, 14013, and 14015 are B type things. The slide delivery device of each optical unit is arranged so that the core of the objective lens 123 of each optical unit may move along with the line passing through the core of the optical information record medium 1, respectively. In addition, in order to use 16 optical units effectively, it is not contained by the cartridge and it is necessary to use the optical information record medium 1 in which record of the information from both sides and playback are possible.

[0125] By the way, in the system containing the optical information record regenerative apparatus and the optical information record medium 1 concerning the gestalt of this operation, it is possible to record a lot of information on the optical information record medium 1 extraordinarily, and such a system fits the application which records the continuous huge information. However, in the system used for such an application, while recording the continuous huge information, supposing it cannot perform informational playback, it will become the system which is very hard to use.

[0126] Then, as shown in drawing 30 thru/or drawing 34 , for example, by forming two or more pickup 111 in one optical information record regenerative apparatus One optical information record medium 1 is used. Perform informational record and playback to coincidence, or It can become possible to perform record and playback to coincidence by two or more pickup 111, the engine performance of record or playback can be raised, and the system which is easy to use also in the application which records the huge information which continued especially can be constituted. Moreover, when retrieving the information on desired out of a lot of information by forming two or more pickup 111 in one optical information record regenerative apparatus, compared with the case where it has only one pickup 111, the engine performance can be raised by leaps and bounds.

[0127] Next, with reference to drawing 35 thru/or drawing 46 , the example of the concrete structure of the optical information record medium 1 in the gestalt of this operation is explained.

[0128] The optical information record medium 1 in the gestalt of this operation has the 1st information layer (hologram layer) on which information is recorded by holography, and the 2nd information layer on which the information and address information for a servo are recorded by the embossing pit etc. And it is necessary to form the interference region of the reference beam for record, and information light in a certain amount of magnitude in the 1st information layer, completing a reference beam so that it may become a minor diameter most in the 2nd information layer. Therefore, with the gestalt of this operation, the gap (gap) of a certain amount of magnitude is formed between the 1st information layer and the 2nd information layer. By this, a reference beam is completed so that it may become a minor diameter most in the 2nd information layer, and it becomes possible to form the interference region of the reference beam for record, and information light in sufficient magnitude in the 1st information layer, making refreshable information recorded on the 2nd information layer. The optical information record medium 1 in the gestalt of this operation can be divided into an air gap type and a transparence substrate gap type by the formation approach of this gap.

[0129] Drawing 35 thru/or drawing 37 show the optical air gap type information record medium 1, drawing 35 is the sectional view of the one half of the optical information record medium 1, drawing 36 is the

decomposition perspective view of the one half of the optical information record medium 1, and drawing 37 is the perspective view of the one half of the optical information record medium 1. This optical information record medium 1 is equipped with the hologram layer 225 joined to the periphery spacer 223 and the inner circumference spacer 224 which separate the reflective substrate 221 with which one field is a reflector, the transparence substrate 222 arranged so that the reflector of this reflective substrate 221 may be countered, and the reflective substrate 221 and the transparence substrate 222 at the predetermined spacing by the field by the side of the reflective substrate 221 in the transparence substrate 222. The air gap of predetermined thickness is formed between the reflector of the reflective substrate 221, and the hologram layer 225. The hologram layer 225 turns into the 1st information layer. PURIGURUBU is formed in the reflector of the reflective substrate 221, and this reflector serves as the 2nd information layer.

[0130] Drawing 38 thru/or drawing 40 show the optical transparence substrate gap type information record medium 1, drawing 38 is the sectional view of the one half of the optical information record medium 1, drawing 39 is the decomposition perspective view of the one half of the optical information record medium 1, and drawing 40 is the perspective view of the one half of the optical information record medium 1. The laminating of the transparence substrate 231, the hologram layer 232 used as the 1st information layer, and the transparence substrate 233 is carried out to this order, and this optical information record medium 1 is constituted. In the hologram layer 232 in the transparence substrate 231, while PURIGURUBU is formed, the reflective film 234 is formed in the field of the opposite side. The field of the opposite side serves as the 2nd information layer in the hologram layer 232 in this transparence substrate 231. Between this 2nd information layer and the hologram layer 232, the gap of the predetermined thickness by the transparence substrate 231 is formed. The transparence substrate 233 is thin compared with the transparence substrate 231.

[0131] Moreover, the optical information record medium 1 in the gestalt of this operation can be divided into an one side type and a double-sided type.

[0132] Drawing 41 thru/or drawing 43 show the optical one side type information record medium 1, and the sectional view of the optical information record medium 1 of a type whose thickness of drawing 41 is 1.2mm, and drawing 42 are explanatory views in which thickness shows the method of an exposure of the reference beam [as opposed to the optical one side type information record medium 1 in the sectional view of the optical information record medium 1 of a type which is 0.6mm, and drawing 43] for record, and information light. The optical information record medium 1 shown in drawing 41 and drawing 42 has structure shown in drawing 38 . However, as for the optical information record medium 1 which showed the optical information record medium 1 shown in drawing 41 to drawing 42 by the thickness of the sum total of the transparence substrate 231, the hologram layer 232, and the transparence substrate 233 being 1.2mm, the thickness of the sum total of the transparence substrate 231, the hologram layer 232, and the transparence substrate 233 is 0.6mm.

[0133] It converges so that it may become a minor diameter most in the field in which PURIGURUBU is formed, and the reference beam 241 for record irradiated by the optical information record medium 1 from an objective lens 123 converges the information light 242 irradiated by the optical information record medium 1 from an objective lens 123 so that it may become a minor diameter from the hologram layer 232 most by the near side. Consequently, in the hologram layer 232, the interference region 243 by the reference beam 241 for record and the information light 242 is formed.

[0134] In addition, although the transparence substrate gap type showed the optical one side type information record medium 1 to drawing 41 and drawing 42 , the optical one side type information record medium 1 may consist of air gap types. In this case, it is made for the thickness of the sum total of the transparence substrate 222, the hologram layer 225, and an air gap to be set to 1.2mm or 0.6mm.

[0135] Drawing 44 thru/or drawing 46 show the optical double-sided type information record medium 1, and drawing 44 is the explanatory view showing the method of an exposure of the reference beam [as opposed to / as opposed to / in the sectional view of the optical transparence substrate gap type information record medium 1, and drawing 45 / the sectional view of the optical air gap type information record medium 1 / the optical double-sided type information record medium 1 in drawing 46] for record, and information light. The optical information record medium 1 shown in drawing 44 has the structure where the optical information record medium of two sheets of the one side type shown in drawing 42 was made to rival by reflective film 234 comrades. Moreover, the optical information record medium 1 shown in drawing 45 has the structure where the optical information record medium of two sheets of the one side type shown in drawing 35 was made to rival by reflective substrate 221 comrades. In addition, in the optical information record medium 1 shown in drawing 45 , the thickness of the sum total of the transparence substrate 222 of

one side, the hologram layer 225, and an air gap is 0.6mm.
[0136] It converges so that it may become a minor diameter most in the field in which PURIGURUBU is formed, and the reference beam 241 for record irradiated by the optical information record medium 1 from an objective lens 123 converges the information light 242 irradiated by the optical information record medium 1 from an objective lens 123 so that it may become a minor diameter from the hologram layer 232,225 most by the near side. Consequently, in the hologram layer 232,225, the interference region 243 by the reference beam 241 for record and the information light 242 is formed.
[0137] By the way, the informational record and the playback for which the optical information record regenerative apparatus in the gestalt of this operation used the conventional optical disk are also attained. For example, it is made to converge so that it may become a minor diameter in the field in which PURIGURUBU is formed in the optical disk 251 in the light irradiated by the optical disk 251 from an objective lens 123 as it was shown in drawing 48 , when using the one side [in which PURIGURUBU was formed in one side of the transparence substrate 252 as shown in drawing 47 , and the reflective film 253 was formed] type optical disk 251, i.e., an information layer, most. In addition, in the optical disk 251 shown in drawing 47 , the thickness of the transparence substrate 252 is 1.2mm. As an optical disk of structure as shown in drawing 47 , there are CD, CD-ROM, CD-R (write-once (Write Once) type CD), MD (mini disc), etc.
[0138] Moreover, it is made to converge so that it may become a minor diameter in the field in which PURIGURUBU is formed in the optical disk 261 in the light irradiated by the optical disk 261 from an objective lens 123 as it was shown in drawing 50 , when using the double-sided [of the structure where the transparence substrate 262 of two sheets in which PURIGURUBU was formed in one side as shown in drawing 49 , and the reflective film 263 was formed was made to rival by reflective film 263 comrades] type optical disk 261, i.e., an information layer, most. In addition, in the optical disk 261 shown in drawing 49 , the thickness of the transparence substrate 262 of one side is 0.6mm. As an optical disk of structure as shown in drawing 50 , there are DVD, DVD-ROM, DVD-RAM, an MO (optical MAG) disk, etc.
[0139] In addition, in the optical information record medium 1 in the gestalt of this operation, the 2nd information layer can be made into the same gestalt also including the information layer in the conventional optical disk as shown in drawing 47 or drawing 49 , and the contents of the information recorded. In this case, the information recorded on the 2nd information layer becomes possible [reproducing by making pickup 111 into the condition at the time of a servo]. moreover, in the information layer in the conventional optical disk By making the 2nd information layer into the same gestalt as the information layer in the conventional optical disk, since the information and address information for a servo are also recorded It becomes possible to use the information and address information for the servo recorded on the information layer in the conventional optical disk as it is for positioning of the information light for the record and playback in a hologram layer, the reference beam for record, and the reference beam for playback. Moreover, as for the application range of the 2nd information layer, it is large that high-speed search becomes possible by recording the directory information of the information recorded on the 1st information layer (hologram layer), directory management information, etc. on the 2nd information layer (information layer in the conventional optical disk) etc.
[0140] Next, before explaining an operation of the optical information record regenerative apparatus concerning the gestalt of this operation, a phase-encoding multiplex principle is explained with reference to drawing 51 and drawing 52 . Drawing 51 is the perspective view showing the configuration of the outline of the general record reversion system which performs phase-encoding multiplex. The space optical modulator 301 with which this record reversion system generates the information light 302 based on two-dimensional digital pattern information, The lens 303 which the information light 302 from this space optical modulator 301 is condensed, and is irradiated to the hologram record medium 300, The phase space optical modulator 304 with which a phase generates the reference beam 305 modulated spatially, and irradiates this reference beam 305 from the direction which carries out an abbreviation rectangular cross with the information light 302 to the hologram record medium 300, It has the lens 307 which condenses the playback light 306 by which outgoing radiation is carried out from the CCD array 308 and the hologram record medium 300 for detecting the reproduced two-dimensional digital pattern information, and irradiates on the CCD array 308.
[0141] In the record reversion system shown in drawing 51 , at the time of record, the information on the subject-copy image to record is digitized, the signal of 0 or 1 is further arranged to two-dimensional, and two-dimensional digital pattern information (henceforth page data) is generated. Here, multiplex record of the page data of #1 - #n shall be carried out at the same hologram record medium 300. Moreover, two-dimensional digital pattern information (henceforth phase data) #1 - #n for phase modulations which is

different in each page data #1-#n of every is generated. First, at the time of record of page data #1, the information light 302 spatially modulated by the space optical modulator 301 is generated based on page data #1, and the hologram record medium 300 is irradiated through a lens 303. Based on phase data #1, with the phase space optical modulator 304, to coincidence, a phase generates the reference beam 305 modulated spatially, and irradiates the hologram record medium 300 at it. Consequently, the interference fringe made by the superposition of the information light 302 and a reference beam 305 is recorded on the hologram record medium 300. Similarly hereafter at the time of record of page data #2 - #n It is based on page data #2 - #n, respectively. With the space optical modulator 301 The information light 302 modulated spatially is generated, and based on phase data #2 - #n, with the phase space optical modulator 304, a phase generates the reference beam 305 modulated spatially, and irradiates these information light 302 and a reference beam 305 at the hologram record medium 300. Thus, multiplex record of two or more information is carried out in the same part in the hologram record medium 300. Thus, information calls a stack the hologram by which multiplex record was carried out. In the example shown in drawing 51 , the hologram record medium 300 has two or more stacks (a stack 1, a stack 2, --, Stack m, --).

[0142] In order to reproduce the page data of arbitration from a stack, based on the same phase data as the time of recording the page data, a phase should just irradiate the reference beam 305 modulated spatially at the stack. If it does so, the reference beam 305 will be alternatively diffracted by the interference fringe corresponding to the phase data and page data, and the playback light 306 will generate it by it. Incidence of this playback light 306 is carried out to the CCD array 308 through a lens 307, and the two-dimensional pattern of playback light is detected by the CCD array 308. And the information on a subject-copy image etc. is reproduced by decoding the two-dimensional pattern of the detected playback light contrary to the time of record.

[0143] Drawing 52 shows signs that an interference fringe is formed to the hologram record medium 300, by interference of the information light 302 and a reference beam 305. In drawing 52 , (a) indicates signs that an interference fringe 3091 is formed to be the information light 3021 based on page data #1 by interference of a reference beam 3051 based on phase data #1. Similarly, signs that an interference fringe 3093 is formed are indicated to be the information light 3022 based on page data #2 in (b), and the information light 3023 based on [the interference of a reference beam 3052 based on phase data #2 shows signs that an interference fringe 3092 is formed, and] page data #3 in (c) by interference of a reference beam 3053 based on phase data #3.

[0144] Next, at the time of a servo, at the time of record, it divides at the time of playback and an operation of the optical information record regenerative apparatus concerning the gestalt of this operation is explained in order.

[0145] First, the operation at the time of a servo is explained with reference to drawing 53 and drawing 54 . Drawing 53 is the explanatory view showing the condition of the pickup 111 at the time of a servo. As for the space optical modulator 125, all pixels are made into a cut off state at the time of a servo. The phase space optical modulator 117 is set up so that all the light that passes each pixel may become the same phase. The output of the outgoing radiation light of light equipment 112 is set as the low-power output for playback. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of an objective lens 123 passes through the address servo area 6 is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of an objective lens 123 passes through the address servo area 6.

[0146] By the collimator lens 113, light by which outgoing radiation was carried out from light equipment 112 is made into the parallel flux of light, and it passes ND filter 114 and the optical element 115 for rotatory polarization in order, and they carry out incidence to a polarization beam splitter 116. It is reflected by polarization beam splitter side 116a, and S polarization component of the light which carried out incidence to the polarization beam splitter 116 is intercepted by the space optical modulator 125. P polarization component of the light which carried out incidence to the polarization beam splitter 116 penetrates polarization beam splitter side 116a, passes the phase space optical modulator 117, and it carries out incidence to a beam splitter 118. It is reflected by beam splitter side 118a, and a part of light which carried out incidence to the beam splitter 118 passes a polarization beam splitter 120, and it carries out incidence to 2 division rotatory-polarization plate 121. Here, the light which passed rotatory-polarization plate 121R of 2 division rotatory-polarization plate 121 turns into B polarization, and the light which passed rotatory-polarization plate 121L turns into A polarization. It is reflected by the starting mirror 122 and condensed with an objective lens 123, and the light which passed 2 division rotatory-polarization plate 121 is irradiated by the information record medium 1 so that it may converge on PURIGURUBU which is in a

back side rather than the hologram layer in the optical information record medium 1. It is reflected on PURIGURUBU, the pit formed on PURIGURUBU becomes irregular in that case, and this light returns to an objective lens 123 side. In addition, the starting mirror 122 is omitted in drawing 53 .

[0147] Return light from the information record medium 1 is made into the parallel flux of light with an objective lens 123, passes 2 division rotatory-polarization plate 121, and turns into S polarization. It is reflected by polarization beam splitter side 120a of a polarization beam splitter 120, and incidence of this return light is carried out to a beam splitter 127, and after a part penetrates beam splitter side 127a and passes a convex lens 129 and a cylindrical lens 130 in order, it is detected by the quadrisection photodetector 131. And while focal error signal FE, the tracking error signal TE, and a regenerative signal RF are generated by the detector 85 and a focus servo and a tracking servo are performed based on these signals based on the output of this quadrisection photodetector 131, playback of a basic clock and distinction of the address are performed.

[0148] Moreover, incidence of a part of light which carried out incidence to the beam splitter 118 is carried out to a photodetector 119, and Signal APCref is generated by the APC circuit 146 based on the output signal of this photodetector 119. And APC is performed so that the quantity of light of the light irradiated by the optical information record medium 1 may become fixed based on this signal APCref. The drive circuit 148 drives a motor 142 and, specifically, adjusts the optical element 115 for rotatory polarization so that Signal APCref may become equal to a predetermined value. Or at the time of a servo, the optical element 115 for rotatory polarization is set up, the output of light equipment 112 is adjusted to it, and it may be made to perform APC at it so that the light which passed the optical element 115 for rotatory polarization may serve as only P polarization component. When the light sensing portion of a photodetector 119 is divided into two or more fields and the phase space optical modulator 117 can also adjust the amount of transmitted lights, the amount of transmitted lights for every pixel in the phase space optical modulator 117 is adjusted, and you may make it adjust based on the output signal for every light sensing portion of a photodetector 119, so that the luminous-intensity distribution irradiated by the optical information record medium 1 may become homogeneity.

[0149] In addition, in a setup at the time of the above-mentioned servo, the configuration of pickup 111 becomes being the same as that of the configuration of pickup of for [to the usual optical disk / record and for playback]. Therefore, the optical information record regenerative apparatus in the gestalt of this operation can also perform record and playback using the usual optical disk.

[0150] Drawing 54 is the explanatory view showing the condition of light [/ near / in case the optical information record regenerative apparatus concerning the gestalt of this operation performs record and playback using the usual optical disk / the optical disk]. In addition, in this drawing, the double-sided type optical disk 261 is mentioned as an example of the usual optical disk. In this optical disk 261, PURIGURUBU 265 is formed in the field by the side of the reflective film 263 in the transparence substrate 262, an optical disk 261 irradiates, the pit formed on PURIGURUBU 265 becomes irregular, and the light from an objective lens 123 side returns to an objective lens 123 side so that it may converge on PURIGURUBU 265.

[0151] Next, the operation at the time of record is explained with reference to drawing 55 thru/or drawing 57 . The explanatory view showing the condition of the pickup 111 of drawing 55 at the time of record, drawing 56 , and drawing 57 are the explanatory views showing the condition of the light near the optical information record medium 1 at the time of record, respectively. In addition, below, as shown in drawing 56 , taking the case of the case where an air gap type thing is used, it explains as an optical information record medium 1.

[0152] At the time of record, the space optical modulator 125 chooses a transparency condition (henceforth ON), and a cut off state (henceforth OFF) for every pixel according to the information to record, modulates the passing light spatially and generates information light. The phase space optical modulator 117 generates the reference beam for record which modulates the phase of light spatially and by which the phase of light was modulated spatially to the passing light by giving phase contrast 0 (rad) or pi (rad) alternatively on the basis of a predetermined phase for every pixel according to a predetermined modulation pattern.

[0153] With the gestalt of this operation, as already explained, in case multiplex record of the information is carried out by phase-encoding multiplex, the core of an objective lens 123 is moved to a data area 7 using access within a visual field so that it may reciprocate within the section when the core of an objective lens 123 includes a part of data area 7 and address servo area 6 of the both sides. When the core of an objective lens 123 comes to the position in a data area 7, the output of light equipment 112 is alternatively made into the high power for record.

[0154] By the collimator lens 113, light by which outgoing radiation was carried out from light equipment 112 is made into the parallel flux of light, and it passes ND filter 114 and the optical element 115 for rotatory polarization in order, and they carry out incidence to a polarization beam splitter 116. P polarization component of the light which carried out incidence to the polarization beam splitter 116 penetrates polarization beam splitter side 116a, passes the phase space optical modulator 117, and in that case, the phase of light is modulated spatially and it serves as a reference beam for record. Incidence of this reference beam for record is carried out to a beam splitter 118. It is reflected by beam splitter side 118a, and a part of reference beam for record which carried out incidence to the beam splitter 118 passes a polarization beam splitter 120, and it carries out incidence to 2 division rotatory-polarization plate 121. Here, the reference beam for record which passed rotatory-polarization plate 121R of 2 division rotatory-polarization plate 121 turns into B polarization, and the reference beam for record which passed rotatory-polarization plate 121L turns into A polarization. It is reflected by the starting mirror 122 and condensed with an objective lens 123, and the reference beam for record which passed 2 division rotatory-polarization plate 121 is irradiated by the optical information record medium 1 so that it may converge by the back side rather than the hologram layer 225 in the optical information record medium 1. In addition, the starting mirror 122 is omitted in drawing 55 .

[0155] On the other hand, it is reflected by polarization beam splitter side 116a, the space optical modulator 125 is passed, it becomes irregular spatially according to the information recorded in that case, and S polarization component of the light which carried out incidence to the polarization beam splitter 116 serves as information light. Incidence of this information light is carried out to a beam splitter 127. It is reflected by beam splitter side 127a, and is reflected by beam splitter side 120a of a polarization beam splitter 120, and incidence of a part of information light which carried out incidence to the beam splitter 127 is carried out to 2 division rotatory-polarization plate 121. Here, the information light which passed rotatory-polarization plate 121R of 2 division rotatory-polarization plate 121 turns into A polarization, and the information light which passed rotatory-polarization plate 121L turns into B polarization. It is reflected by the starting mirror 122 and condensed with an objective lens 123, and once converging and being spread in a near side, rather than the hologram layer 225 in the optical information record medium 1, the information light which passed 2 division rotatory-polarization plate 121 is irradiated by the optical information record medium 1 so that the hologram layer 225 may be passed.

[0156] Consequently, as shown in drawing 56 , in the hologram layer 225, the interference region 313 by the reference beam 311 for record and the information light 312 is formed. This interference region 313 makes a slack-like gestalt. In addition, as shown in drawing 55 , the convergence location of information light can be adjusted by adjusting the location 310 of a convex lens 126, and, thereby, the magnitude of an interference region 313 can be adjusted.

[0157] As shown in drawing 57 , within the hologram layer 225 Reference beam 311A for record of A polarization which passed rotatory-polarization plate 121L of 2 division rotatory-polarization plate 121, Reference beam 311B for record of B polarization which information light 312A of A polarization which passed rotatory-polarization plate 121R of 2 division rotatory-polarization plate 121 interfered, and passed rotatory-polarization plate 121R of 2 division rotatory-polarization plate 121, Information light 312B of B polarization which passed rotatory-polarization plate 121L of 2 division rotatory-polarization plate 121 interferes, and these interference patterns are recorded in volume in the hologram layer 225.

[0158] Moreover, multiplex record of two or more information can be carried out in the same part of the hologram layer 225 by [which are recorded] changing the modulation pattern of the phase of the reference beam for record for every information.

[0159] By the way, as shown in drawing 55 , incidence of a part of reference beam for record which carried out incidence to the beam splitter 118 is carried out to a photodetector 119, and Signal APCref is generated by the APC circuit 146 based on the output signal of this photodetector 119. Moreover, incidence of a part of information light which carried out incidence to the beam splitter 127 is carried out to a photodetector 128, and Signal APCobj is generated by the APC circuit 147 based on the output signal of this photodetector 128. And APC is performed so that the ratio of the reference beam for record irradiated by the optical information record medium 1 and information luminous intensity may serve as optimal value based on these signals APCref and APCobj. The drive circuit 148 drives a motor 142 and, specifically, adjusts the optical element 115 for rotatory polarization so that Signal APCref and APC<SUB>obj may be compared and these may serve as a desired ratio. When the light sensing portion of a photodetector 119 is divided into two or more fields and the phase space optical modulator 117 can also adjust the amount of transmitted lights, the amount of transmitted lights for every pixel in the phase space optical modulator 117 is adjusted, and you

may make it adjust based on the output signal for every light sensing portion of a photodetector 119, so that the intensity distribution of the reference beam for record irradiated by the optical information record medium 1 may become homogeneity. When similarly the light sensing portion of a photodetector 128 is divided into two or more fields and the space optical modulator 125 can also adjust the amount of transmitted lights, the amount of transmitted lights for every pixel in the space optical modulator 125 is adjusted, and you may make it adjust based on the output signal for every light sensing portion of a photodetector 128, so that the information luminous-intensity distribution irradiated by the optical information record medium 1 may become homogeneity.

[0160] Moreover, with the gestalt of this operation, based on the sum of Signals APCref and APCobj, APC is performed so that the reinforcement of the sum total of the reference beam for record and information light may serve as optimal value. As an approach of controlling the reinforcement of the sum total of the reference beam for record, and information light, there is control of the time profile of control of the peak value of the output of light equipment 112, the outgoing radiation pulse width in the case of carrying out outgoing radiation of the light in pulse, and outgoing radiation luminous intensity etc.

[0161] Next, the operation at the time of fixing is explained with reference to drawing 58 and drawing 59 . The explanatory view and drawing 59 which show the condition of the pickup 111 of drawing 58 at the time of fixing are the explanatory view showing the condition of the light near the optical information record medium 1 at the time of fixing. As for the space optical modulator 125, all pixels are made into a cut off state at the time of fixing. The phase space optical modulator 117 is set up so that all the light that passes each pixel may become the same phase. From light equipment 112, outgoing radiation of the light is not carried out, but outgoing radiation of the ultraviolet radiation of S polarization for fixing is carried out from the light equipment 135 for fixing.

[0162] By the collimator lens 134, light by which outgoing radiation was carried out from the light equipment 135 for fixing is made into the parallel flux of light, and carries out incidence to a polarization beam splitter 116, and it is reflected by polarization beam splitter side 116a, and it passes the phase space optical modulator 117, and it carries out incidence to a beam splitter 118. It is reflected by beam splitter side 118a, and a part of light which carried out incidence to the beam splitter 118 passes a polarization beam splitter 120, and it carries out incidence to 2 division rotatory-polarization plate 121. Here, the light which passed rotatory-polarization plate 121R of 2 division rotatory-polarization plate 121 turns into B polarization, and the light which passed rotatory-polarization plate 121L turns into A polarization. It is reflected by the starting mirror 122 and condensed with an objective lens 123, and the light which passed 2 division rotatory-polarization plate 121 is irradiated by the information record medium 1 so that it may converge on PURIGURUBU which is in a back side rather than the hologram layer 225 in the optical information record medium 1. And this light is fixed to the interference pattern currently formed in the interference region 313 in the hologram layer 225. In addition, the starting mirror 122 is omitted in drawing 58 .

[0163] In addition, positioning (servo) of the light for fixing to the optical information record medium 1 can be performed like positioning of the reference beam for record at the time of record, and information light.

[0164] Moreover, incidence of a part of light for fixing which carried out incidence to the beam splitter 118 is carried out to a photodetector 119, and Signal APCref is generated by the APC circuit 146 based on the output signal of this photodetector 119. And APC is performed so that the quantity of light of the light for fixing irradiated by the optical information record medium 1 may become fixed based on this signal APCref. Specifically, the output of the light equipment 135 for fixing is adjusted so that Signal APCref may become equal to a predetermined value. When the light sensing portion of a photodetector 119 is divided into two or more fields and the phase space optical modulator 117 can also adjust the amount of transmitted lights, the amount of transmitted lights for every pixel in the phase space optical modulator 117 is adjusted, and you may make it adjust based on the output signal for every light sensing portion of a photodetector 119, so that the luminous-intensity distribution for fixing irradiated by the optical information record medium 1 may become homogeneity.

[0165] Next, the operation at the time of playback is explained with reference to drawing 60 thru/or drawing 62 . The explanatory view showing the condition of the pickup 111 of drawing 60 at the time of playback, drawing 61 , and drawing 62 are the explanatory views showing the condition of the light near the optical information record medium 1 at the time of playback, respectively.

[0166] As for the space optical modulator 125, all pixels are made into a cut off state at the time of playback. The phase space optical modulator 117 generates the reference beam for playback which modulates the phase of light spatially and by which the phase of light was modulated spatially to the passing

light by giving phase contrast 0 (rad) or pi (rad) alternatively on the basis of a predetermined phase for every pixel according to a predetermined modulation pattern. Here, let the modulation patterns of the phase of the reference beam for playback be the modulation pattern of the phase of the reference beam for record at the time of record of the information which it is going to reproduce, and a pattern symmetrical with a point to the core of the phase space optical modulator 117 in this example.

[0167] By the collimator lens 113, light by which outgoing radiation was carried out from light equipment 112 is made into the parallel flux of light, and it passes ND filter 114 and the optical element 115 for rotatory polarization in order, and they carry out incidence to a polarization beam splitter 116. It is reflected by polarization beam splitter side 116a, and S polarization component of the light which carried out incidence to the polarization beam splitter 116 is intercepted by the space optical modulator 125. P polarization component of the light which carried out incidence to the polarization beam splitter 116 penetrates polarization beam splitter side 116a, passes the phase space optical modulator 117, and in that case, the phase of light is modulated spatially and it serves as a reference beam for playback. Incidence of this reference beam for playback is carried out to a beam splitter 118. It is reflected by beam splitter side 118a, and a part of reference beam for playback which carried out incidence to the beam splitter 118 passes a polarization beam splitter 120, and it carries out incidence to 2 division rotatory-polarization plate 121. Here, the reference beam for playback which passed rotatory-polarization plate 121R of 2 division rotatory-polarization plate 121 turns into B polarization, and the reference beam for playback which passed rotatory-polarization plate 121L turns into A polarization. It is reflected by the starting mirror 122 and condensed with an objective lens 123, and the reference beam for playback which passed 2 division rotatory-polarization plate 121 is irradiated by the optical information record medium 1 so that it may converge by the back side rather than the hologram layer 225 in the optical information record medium 1. In addition, the starting mirror 122 is omitted in drawing 60 .

[0168] In addition, positioning (servo) of the reference beam for playback to the optical information record medium 1 can be performed like positioning of the reference beam for record at the time of record, and information light.

[0169] As shown in drawing 62 , reference beam 315B for playback of B polarization which passed rotatory-polarization plate 121R of 2 division rotatory-polarization plate 121 passes the hologram layer 225, and it reflects in the reflector in the convergence location by the side of the back of the hologram layer 225, and it passes the hologram layer 225 again. At this time, reference beam 315B for playback of Ushiro reflected in the reflector passes through the part where reference beam 311A for record was irradiated in the interference region 313 at the time of record, and has become the light of the same modulation pattern as reference beam 311A for record. Therefore, playback light 316B corresponding to information light 312A at the time of record occurs from an interference region 313 by this reference beam 315B for playback. This playback light 316B advances to an objective lens 123 side.

[0170] Similarly, reference beam 315A for playback of A polarization which passed rotatory-polarization plate 121L of 2 division rotatory-polarization plate 121 passes the hologram layer 225, and it reflects in the reflector in the convergence location by the side of the back of the hologram layer 225, and it passes the hologram layer 225 again. At this time, reference beam 315A for playback of Ushiro reflected in the reflector passes through the part where reference beam 311B for record was irradiated in the interference region 313 at the time of record, and has become the light of the same modulation pattern as reference beam 311B for record. Therefore, playback light 316A corresponding to information light 312B at the time of record occurs from an interference region 313 by this reference beam 315A for playback. This playback light 316A advances to an objective lens 123 side.

[0171] After playback light 316B of B polarization passes an objective lens 123, it passes rotatory-polarization plate 121R of 2 division rotatory-polarization plate 121, and becomes the light of P polarization. After playback light 316A of A polarization passes an objective lens 123, it passes rotatory-polarization plate 121L of 2 division rotatory-polarization plate 121, and becomes the light of P polarization. Incidence of the playback light which passed 2 division rotatory-polarization plate 121 is carried out to a polarization beam splitter 120, and it penetrates polarization beam splitter side 120a, and it carries out incidence to a beam splitter 118. A part of playback light which carried out incidence to the beam splitter 118 penetrates beam splitter side 118a, it passes the image formation lens 132, and it carries out incidence to the CCD array 133. In addition, as shown in drawing 60 , the image formation condition of the playback light to the CCD array 133 can be adjusted by adjusting the location of the image formation lens 132.

[0172] On the CCD array 133, image formation of the pattern of ON by the space optical modulator 125 at the time of record and OFF is carried out, and information is reproduced by detecting this pattern. In

addition, when the modulation pattern of the reference beam for record is changed and multiplex record of two or more information is carried out at the hologram layer 225, only the information corresponding to the reference beam for record of the modulation pattern of the reference beam for playback and a modulation pattern symmetrical with a point is reproduced among two or more information.

[0173] Moreover, incidence of a part of reference beam for playback which carried out incidence to the beam splitter 118 is carried out to a photodetector 119, and Signal APCref is generated by the APC circuit 146 based on the output signal of this photodetector 119. And APC is performed so that the quantity of light of the reference beam for playback irradiated by the optical information record medium 1 may become fixed based on this signal APCref. The drive circuit 148 drives a motor 142 and, specifically, adjusts the optical element 115 for rotatory polarization so that Signal APCref may become equal to a predetermined value. Or at the time of playback, the optical element 115 for rotatory polarization is set up, the output of light equipment 112 is adjusted to it, and it may be made to perform APC at it so that the light which passed the optical element 115 for rotatory polarization may serve as only P polarization component. When the light sensing portion of a photodetector 119 is divided into two or more fields and the phase space optical modulator 117 can also adjust the amount of transmitted lights, the amount of transmitted lights for every pixel in the phase space optical modulator 117 is adjusted, and you may make it adjust based on the output signal for every light sensing portion of a photodetector 119, so that the intensity distribution of the reference beam for playback irradiated by the optical information record medium 1 may become homogeneity.

[0174] In the gestalt of this operation, the CCD array 133 also uses what can detect the light of three colors of R, G, and B for the laser beam of three colors of R, G, and B, using the thing in which outgoing radiation is possible as light equipment 112. Further moreover, as an optical information record medium 1 By using what has the three-layer hologram layer from which an optical property changes only with the light of each color of R, G, and B, respectively, by the same modulation pattern of the reference beam for record It becomes possible to record three kinds of information on the same part of the optical information record medium 1, and it becomes possible to carry out multiplex record of more information. as the record medium which has the three-layer above hologram layers -- for example, HRFmade from DuPont- there is 700X059-20 (trade name).

[0175] As mentioned above, in performing multiplex record of the information by the light of three colors of R, G, and B, it records information by time sharing for every color of R, G, and B to the same part of the optical information record medium 1. Although the modulation pattern of information light is changed for every color of R, G, and B in that case, the modulation pattern of the reference beam for record is not changed. When each pixel of the information light for every color supports the information on binary (i.e., when each pixel is expressed by ** or dark), here It becomes possible from performing multiplex record of the information by the light of three colors of R, G, and B to record the information on eight (= 23) value per each pixel by setting B to LSB (least significant bit), setting R as MSB (most significant bit). When the space optical modulator 125 can adjust the amount of transmitted lights more than a three-stage and each pixel of the information light for every color supports the information on n (n is three or more integers) gradation, it becomes possible from performing multiplex record of the information by the light of three colors of R, G, and B to record the information on n3 value per each pixel.

[0176] Various approaches are possible for playback of the information at the time of performing multiplex record of the information by the light of three colors of R, G, and B as follows. That is, only the information recorded using the light of any 1 color of R, G, and B, then the light of the same color as the reference beam for playback in the reference beam for playback is reproduced. When the reference beam for playback is made into the light of two colors of the arbitration of R, G, and the B, only two kinds of information recorded using the light of the two same colors as the reference beam for playback is reproduced. Two kinds of this information is divided into the information for every color in the CCD array 133. Moreover, when the reference beam for playback is made into the light of three colors of R, G, and B, all of three kinds of information recorded using the light of three colors are reproduced. Three kinds of this information is divided into the information for every color in the CCD array 133. In addition, when the optical information record medium 1 has a layer for every color of R, G, and B, in the layer for every color, phase-encoding multiplex performs multiplex record, respectively. This does so the effectiveness that the reconstruction image of the pattern for every color of R, G, and B is acquired, for every modulation pattern of the phase of a reference beam.

[0177] Next, with reference to drawing 63 and drawing 64 , the direct rendering (it is described as DRAW below Direct Rrad After Write;.) function which the optical information record regenerative apparatus

concerning the gestalt of this operation has, and the light power control (it is described as WPC below Write Power Control;.) function at the time of multiplex record are explained.
[0178] Introduction and a DRAW function are explained. A DRAW function is a function which reproduces recorded information immediately after informational record. It becomes possible to collate recorded information immediately after informational record by this function (Verify).
[0179] Hereafter, with reference to drawing 55 and drawing 57 , the principle of the DRAW function in the gestalt of this operation is explained. First, in the gestalt of this operation, in using a DRAW function, let the modulation pattern of the reference beam for record be a pattern symmetrical with a point to the core of the phase space optical modulator 117. Reference beam 311A for record of A polarization which passed rotatory-polarization plate 121L of 2 division rotatory-polarization plate 121 within the hologram layer 225 at the time of record, Reference beam 311B for record of B polarization which information light 312A of A polarization which passed rotatory-polarization plate 121R of 2 division rotatory-polarization plate 121 interfered, and passed rotatory-polarization plate 121R of 2 division rotatory-polarization plate 121, Information light 312B of B polarization which passed rotatory-polarization plate 121L of 2 division rotatory-polarization plate 121 interferes, and these interference patterns are recorded in volume in the hologram layer 225.
[0180] Thus, if an interference pattern begins to be recorded in the hologram layer 225, the playback light of A polarization will occur from the part where the interference pattern was recorded by reference beam 311B for record by the light reflected in the reflector which has reference beam 311A for record of A polarization which passed rotatory-polarization plate 121L of 2 division rotatory-polarization plate 121 in the convergence location by the side of the back of the hologram layer 225. After this playback light advances to an objective lens 123 side and passes an objective lens 123, it passes rotatory-polarization plate 121L of 2 division rotatory-polarization plate 121, and turns into light of P polarization. The playback light of B polarization occurs from the part where the interference pattern was recorded by reference beam 311A for record by the light reflected in the reflector which similarly has reference beam 311B for record of B polarization which passed rotatory-polarization plate 121R of 2 division rotatory-polarization plate 121 in the convergence location by the side of the back of the hologram layer 225. After this playback light advances to an objective lens 123 side and passes an objective lens 123, it passes rotatory-polarization plate 121R of 2 division rotatory-polarization plate 121, and turns into light of P polarization. Incidence of the playback light which passed 2 division rotatory-polarization plate 121 is carried out to a polarization beam splitter 120, and it penetrates polarization beam splitter side 120a, and it carries out incidence to a beam splitter 118. A part of playback light which carried out incidence to the beam splitter 118 penetrates beam splitter side 118a, and it passes the image formation lens 132, and incidence of it is carried out to the CCD array 133, and it is detected. Thus, the recorded information is reproducible immediately after informational record.
[0181] In drawing 63 , a sign 321 shows an example of the relation between the elapsed time after the recording start of the information in one place of the optical information record medium 1, and the output level of the CCD array 133. Thus, after an informational recording start, according to the degree of record of the interference pattern in the optical information record medium 1, the output level of the CCD array 133 becomes large gradually, reaches maximum in a certain time of day, and becomes small gradually after that. It can be said that the diffraction efficiency by the recorded interference pattern (henceforth a record pattern) is large, so that the output level of the CCD array 133 is large. Therefore, the record pattern of desired diffraction efficiency can be formed by stopping record, when the output level of the CCD array 133 turns into an output level corresponding to desired diffraction efficiency at the time of record.
[0182] With the gestalt of this operation, in order to form the record pattern of desired diffraction efficiency preferably using a DRAW function as mentioned above, a test area is suitably prepared in the optical information record medium 1. With a test area, it is the field which can record information by holography like a data area 7. And a controller 90 performs the following actuation preferably at the time of informational record. That is, a controller 90 performs beforehand actuation which records the predetermined data for a test in a test area, and detects the profile of the output level of the CCD array 133 as shown in drawing 63 . At this time, prèferably, the ratio of the output of light equipment 112 and the quantity of light of the reference beam for record and information light is changed, and it is [two or more / in a test area]. As record of the data for a test and detection actuation of the profile of the output level of the CCD array 133 are performed, for example, signs 321-323 showed drawing 63 Two or more profiles are detected and it is made to perform record actuation of actual information on the conditions corresponding to the profile which chose and chose the optimal profile out of it.

[0183] Moreover, a controller 90 finds the output level corresponding to desired diffraction efficiency, or the time amount from the recording start from which the output level is obtained based on the detected profile or the selected profile. In the case of actual informational record, a controller 90 supervises the output level of the CCD array 133, and if the output level reaches the output level corresponding to the diffraction efficiency of the request for which it asked beforehand, it will stop record. Or in the case of actual informational record, if a controller 90 reaches time amount from the recording start from which the output level corresponding to the diffraction efficiency of the request for which the elapsed time after initiation of record asked beforehand is obtained, it will stop record. Such actuation enables it to form the record pattern of desired diffraction efficiency to the optical information record medium 1.
[0184] Moreover, with the gestalt of this operation, recorded information can be collated as mentioned above using a DRAW function. circuitry required in order that drawing 64 may perform this collating in the optical information record regenerative apparatus concerning the gestalt of this operation was shown -- it is. As shown in this drawing, an optical information record regenerative apparatus The information to record is given from a controller 90 and it is a space optical modulator (drawing 64 describes SLM.) about this information. The encoder 331 encoded so that it may become data of the modulation pattern of 125, The decoder 322 which decrypts the output data of the CCD array 133 so that it may become data of the gestalt to which it is given by the encoder 331 from a controller 90, The data given to an encoder 331 from a controller 90 are compared with the data obtained by the decoder 322, and it has the comparator 333 which sends the information on a comparison result to a controller 90. A comparator 333 sends whenever [two data's which make information's on comparison result, for example, are compared coincidence], or, the information on an error rate (error rate) to a controller 90. When the information on the comparison result sent from a comparator 333 is within the limits which can restore the error of data, a controller 90 continues record actuation, and when [that the information on a comparison result can restore the error of data] out of range, it stops record actuation.
[0185] Thus, according to the optical information record regenerative apparatus concerning the gestalt of this operation, since it has the DRAW function, even if there is disturbance of the sensibility unevenness of the optical information record medium 1, change of external environmental temperature, and the output of light equipment 112, such as fluctuation, record actuation can be performed in the state of the optimal record.
[0186] Moreover, since it has the function which collates informational record and information recorded on coincidence according to the gestalt of this operation, a high speed is recordable, maintaining high dependability. Especially this function is useful when recording information on a high transfer rate. Since the check of the information recorded during record actuation by the function of collating in the gestalt of this operation in the operation with same with performing overwrite reproducing information in the condition that informational fixing is not performed although it was not desirable since the quality of nothing and the recorded information was made to deteriorate is completed, a problem produces.
[0187] Next, the WPC function at the time of multiplex record is explained. When changing the modulation pattern of the reference beam for record and carrying out multiplex record of two or more information in the same part of the optical information record medium 1, the diffraction efficiency of the record pattern with which record was performed previously falls gradually by record performed after that. each record pattern for every information by which multiplex record is carried out with the WPC function in the gestalt of this operation at the time of multiplex record -- abbreviation -- as the same diffraction efficiency is acquired, it is the function which controls the reference beam for record and information light at the time of record.
[0188] Here, the diffraction efficiency of a record pattern carries out record of how many times of sum totals to the same part of the modulation pattern of the irradiation time of the reference beam for record and information luminous intensity, the reference beam for record, and information light, the reference beam for record, and an information luminous-intensity ratio and the reference beam for record, and the optical information record medium 1, and depends for it on the parameter of the what time record of them etc. Therefore, what is necessary is just to control at least one of two or more of these parameters by the WPC function. What is necessary is just to control the reference beam for record and information luminous intensity, and irradiation time, in order to control simply. In controlling the reference beam for record, and information luminous intensity, the record performed behind makes reinforcement small. In controlling the irradiation time of the reference beam for record, and information light, the record performed behind shortens irradiation time.
[0189] It is based on the profile of the output level of the CCD array 133 as shown in drawing 63 for which it asked beforehand, and the reference beam for record and information light at the time of record of eye 1 -

m (m is two or more integers) time are controlled by the WPC function in the gestalt of this operation. The example of the irradiation time in the case of controlling the irradiation time of the reference beam for record and information light is shown in drawing 63 . That is, five records shall be carried out to the same part of the optical information record medium 1, and T1, T2, T3, T four, and T5 express the irradiation time of the reference beam for record at the time of the 5th record, and information light with the example shown in drawing 63 at the time of the 4th record at the time of the 3rd record at the time of the 2nd record at the time of the 1st record, respectively.

[0190] Thus, according to the gestalt of this operation, abbreviation etc. can spread and carry out diffraction efficiency of each record pattern for every information by which multiplex record is carried out.

[0191] By the way, according to the optical information record regenerative apparatus concerning the gestalt of this operation, it becomes possible to record a lot of information on the optical information record medium 1 at high density. This means that the amount of the information lost by it also becomes large, if a defect etc. arises in the optical information record medium 1 and it becomes impossible to reproduce a part of information after informational record. With the gestalt of this operation, since lack of such information is prevented and dependability is raised, information adapting a RAID (Redundant Arrays of Inexpensive Disks) technique can be recorded so that it may explain below.

[0192] A RAID technique is a technique which raises the dependability of record by using two or more hard disk drive units, and recording data as having redundancy. RAID is classified into five from RAID-1 to RAID-5. The following explanation explains taking the case of typical RAID-1, RAID-3, and RAID-5. RAID-1 is a method which writes in the same contents as two hard disk drive units, and it is also called mirroring. RAID-3 are a method which generates parity data and is written in other one hard disk drive unit while they divide input data into fixed die length and record it on two or more hard disk drive units. RAID-5 are a method which distributes a parity block to all hard disk drive units while recording them on other hard disk drive units by considering the parity data to the data block which corresponds mutually [each hard disk drive unit] while enlarging the unit (block) of division of data and recording on one hard disk drive unit by making one division data into a data block as a parity block.

[0193] The informational record approach (henceforth the distributed record approach) of having applied the RAID technique in the gestalt of this operation transposes the hard disk drive unit under explanation of above-mentioned RAID to the interference region 313 in the optical information record medium 1, and records information.

[0194] Drawing 65 is the explanatory view showing an example of the distributed record approach in the gestalt of this operation. In this example, the information which should be recorded on the optical information record medium 1 is recording on a series of data DAT A1, DATA2, and DATA3 and two or more interference regions 313a-313e which shall be -- and can set the same data DAT A1, DATA2, and DATA3 and -- to the optical information record medium 1. In addition, in each interference regions 313a-313e, multiplex record of two or more data is carried out by phase-encoding multiplex, respectively. This record approach corresponds to RAID-1. According to this record approach, even if playback of data becomes impossible in either of two or more interference regions 313a-313e, data are reproducible from other interference regions.

[0195] Drawing 66 is the explanatory view showing other examples of the distributed record approach in the gestalt of this operation. In this example, while the information which should be recorded on the optical information record medium 1 shall be a series of data DAT A1, DATA2, DATA3, --, DATA12, divides this data and records on two or more interference regions 313a-313d, the parity data to the data recorded on two or more interference regions 313a-313d are generated, and this parity data is recorded on interference region 313e. When it explains more concretely, by this record approach Data DAT A1-DATA4 is recorded on interference regions 313a-313d, respectively. The parity data PARITY to data DAT A1-DATA4 (1-4) are recorded on interference region 313e. Data DAT A5 - DATA8 are recorded on interference regions 313a-313d, respectively. The parity data PARITY to data DAT A5 - DATA8 (5-8) are recorded on interference region 313e. Data DAT A9 - DATA12 are recorded on interference regions 313a-313d, respectively, and the parity data PARITY to data DAT A9 - DATA12 (9-12) are recorded on interference region 313e. In addition, in each interference regions 313a-313e, multiplex record of two or more data is carried out by phase-encoding multiplex, respectively. This record approach corresponds to RAID-3. According to this record approach, even if playback of data becomes impossible in two or more interference regions [313a-313d] either, data can be restored using the parity data currently recorded on interference region 313e.

[0196] Drawing 67 is the explanatory view showing the example of further others of the distributed record approach in the gestalt of this operation. In this example, the information which should be recorded on the

optical information record medium 1 shall be a series of data DAT A1, DATA2, DATA3, --, DATA12, and divides this data. While recording on four interference regions among two or more interference regions 313a-313e, the parity data to the data recorded are generated and this parity data is recorded on the remaining interference regions of two or more interference regions 313a-313e. Moreover, by this approach, a sequential change of the interference region which records parity data is made. When it explains more concretely, by this record approach Data DAT A1-DATA4 is recorded on interference regions 313a-313d, respectively. The parity data PARITY to data DAT A1-DATA4 (1-4) are recorded on interference region 313e. Data DAT A5 - DATA8 are recorded on interference regions 313a-313c and 313e, respectively. The parity data PARITY to data DAT A5 - DATA8 (5-8) are recorded on 313d of interference regions. Data DAT A9 - DATA12 are recorded on interference regions 313a, 313b, 313d, and 313e, respectively, and the parity data PARITY to data DAT A9 - DATA12 (9-12) are recorded on interference region 313c. In addition, in each interference regions 313a-313e, multiplex record of two or more data is carried out by phase-encoding multiplex, respectively. This record approach corresponds to RAID-5. According to this record approach, even if playback of data becomes impossible in either of two or more interference regions which recorded data, data can be restored using parity data.

[0197] For example, the distributed record approach as shown in drawing 65 thru/or drawing 67 is performed under control of the controller 90 as a control means.

[0198] Drawing 68 shows an example of arrangement of two or more interference regions used by the above-mentioned distributed record approach. In this example, the interference region used by the distributed record approach is made into two or more interference regions 313 adjoined in one truck. In this case, as for two or more interference regions 313 used by the distributed record approach, it is desirable to consider as the interference region within the limits in which access within a visual field is possible. That is because a high speed can be accessed to each interference region 313.

[0199] Drawing 69 shows other examples of arrangement of two or more interference regions used by the above-mentioned distributed record approach. In this example, two or more interference regions used by the distributed record approach are made into two or more interference regions 313 which adjoin in radial [331] and the direction 332 of a truck of the optical information record medium 1 two-dimensional. In this case, as for two or more interference regions 313 which adjoin in the direction 332 of a truck among two or more interference regions used by the distributed record approach, it is desirable to consider as the interference region within the limits in which access within a visual field is possible. That is because a high speed can be accessed to each interference region 313 which adjoins in the direction 332 of a truck.

[0200] In addition, two or more interference regions 313 located at intervals are distributed without recording on two or more adjoining interference regions 313, and you may make it record a series of data by the distributed record approach in the gestalt of this operation.

[0201] Although the distributed record approach in the case of carrying out multiplex record of two or more data by phase-encoding multiplex has been explained to one interference region 313 so far, when carrying out multiplex record of two or more data, the distributed record approach can be realized by other approaches. As the example, the distributed record approach in the case of carrying out multiplex record of two or more data using the approach of shift multiplexing (shift multiplexing) is explained with reference to drawing 70 . Shift multiplexing is the approach of forming two or more interference regions 313 to the optical information record medium 1, so that it may shift horizontal little by little mutually and a part may lap, and carrying out multiplex record of two or more information, as shown in drawing 70 . In addition, although drawing 70 showed the example by which two or more interference regions 313 used by the distributed record approach are arranged two-dimensional, two or more interference regions 313 used by the distributed record approach may be arranged so that it may adjoin in the same truck. Moreover, in drawing 70 , the arrow head shown with the sign 334 expresses the sequence of record. By the distributed record approach using multiplexing, data and parity data which were divided from a series of data are distributed and recorded on two or more interference regions 313.

[0202] Moreover, when using together phase-encoding multiplex and shift multiplexing and carrying out multiplex record of two or more data, the distributed record approach can be realized. Drawing 71 shows the example formed so that the interference region 313 which carries out multiplex record of the information by phase-encoding multiplex might be formed without lapping mutually, and the interference region 313 which adjoins about radial [of the information record medium 1 / 331] using shift multiplexing might shift horizontal little by little mutually and a part might lap about the direction 332 of a truck of the information record medium 1. Each interference region 313 in this example is treated like the interference regions 313a-313e in drawing 65 thru/or drawing 67 , respectively.

[0203] Next, with reference to drawing 72 and drawing 73 , the JUKU equipment using the optical information record regenerative apparatus applied to the gestalt of this operation as an application of the optical information record regenerative apparatus concerning the gestalt of this operation is explained. In addition, JUKU equipment is a mass information record regenerative apparatus which has the autochanger style which exchanges record media.
[0204] The perspective view in which drawing 72 shows the appearance of JUKU equipment, and drawing 73 are the block diagrams showing the circuitry of JUKU equipment. The front panel block 401 with which this JUKU equipment was formed in the whole surface side of JUKU equipment, The robotics block 402 which constitutes the interior of JUKU equipment, and the rear panel block 403 formed in the rear-face side of JUKU equipment, The 1st disk array 404 to which it is prepared in the interior of JUKU equipment, and comes to connect two or more optical information record regenerative apparatus, It has the 2nd disk array 405 to which it comes to connect two or more same optical information record regenerative apparatus, and the electric power supply block 406 which supplies predetermined power to each part of JUKU equipment.
[0205] The front panel block 401 is equipped with the front door 407 opened and closed in case each disk array 404,405 is exchanged, and the front panel 408.
[0206] The keypad 409 which has various actuation keys in the front panel 408, For example, the display 410 for displaying a mode of operation etc. and the functional switch 411 for specifying closing motion of a front door 407, While transmitting to the mail slot 412 which are insertion of the optical information record medium 1 and an exhaust port, and the mail box which does not illustrate the optical information record medium 1 inserted through the mail slot 412 The motor 413 for a transfer which transmits the optical information record medium 1 to discharge to a mail slot 412 from a mail box, and the full sensor 414 which detects that the optical information record medium 1 inserted into JUKU equipment reached convention number of sheets are formed.
[0207] The door sensor 415 which detects the switching condition of a front door 407, the door-lock solenoid 416 for carrying out closing motion control of the front door 407, and the interlock switch 417 which carries out closing motion control of the front door 407 according to actuation of the functional switch 411 are formed in the front door 407.
[0208] The robotics block 402 is established so that a laminating may be carried out to the top-face section of the lower magazine 421 which can contain the optical information record medium 1 of ten sheets, and this lower magazine 421 to that interior, and it has the up magazine 422 which can contain the optical information record medium 1 of ten sheets, and the controller block 423 which performs control of the whole JUKU equipment in that interior.
[0209] Moreover, the motor 424 for grip actuation for the robotics block 402 to control the grip actuation of the manipulator which is not illustrated for which the optical information record medium 1 inserted into JUKU equipment is moved to a predetermined part, The motor controller 425 for grip actuation which controls the rotational frequency and hand of cut of the motor 424 for grip actuation according to control of the controller block 423, The engine speed and hand of cut of the motor 424 for grip actuation are detected, and it has the encoder 426 for grip actuation which supplies this detection data to the controller block 23. Moreover, the robotics block 402 detects the rotational-motion operation motor 427 for carrying out the roll control of the manipulator to the direction of a clockwise rotation, the direction of a counterclockwise rotation, or a longitudinal direction, the rotational-motion operation motor controller 428 which controls the rotational frequency and the hand of cut of the rotational-motion operation motor 427 according to control of the controller block 423, and the rotational frequency and the hand of cut of the rotational-motion operation motor 427, and has the rotational-motion operation encoder 429 which supplies this detection data to the controller block 423. Moreover, robotics block 402 detects the vertical-movement operation motor 430 for carrying out migration control of the manipulator in the vertical direction, the vertical-movement operation motor controller 431 which controls the rotational frequency and the hand of cut of the vertical-movement operation motor 430 according to control of the controller block 423, and the rotational frequency and the hand of cut of a vertical-movement operation motor 430, and has the vertical-movement operation encoder 432 which supplies to the controller block 423 in this detection data.
[0210] Moreover, the robotics block 402 has the motor controller 433 for a transfer which controls the rotational frequency and hand of cut of the motor 413 for a transfer for performing insertion discharge actuation of the optical information record medium 1 through a mail slot 412, and the clear pass sensor 434 and the clear pass emitter 420.
[0211] The rear panel block 403 has the connector terminal 435 for RS232C which is an input/output terminal for serial transmissions, the connector terminal 436 for UPS (Uninterruptible Power System), the

1st connector terminal 437 for SCSI (Small Computer System Interface) which is an input/output terminal for parallel transmission, the 2nd connector terminal 438 for SCSI which is the same input/output terminal for parallel transmission, and AC (alternating current) power-source connector terminal 439 connected to a source power supply.
[0212] The connector terminal 435 for RS232C and the connector terminal 436 for UPS are connected to the controller block 423, respectively. The controller block 423 changes the parallel data from each disk array 404,405 into serial data, and supplies them to the connector terminal 435 for RS232C while it changes into parallel data the serial data supplied through the connector terminal 435 for RS232C and supplies it to each disk array 404,405.
[0213] Moreover, each connector terminal 437,438 for SCSI is connected to the controller block 423 and each disk array 404,405. Each disk array 404,405 delivers immediate data through each connector terminal 437,438 for SCSI, and the controller block 423 changes the parallel data from each disk array 404,405 into serial data, and it supplies it to the connector terminal 435 for RS232C.
[0214] Moreover, the AC power connector terminal 439 is connected to the electric power supply block 406. The electric power supply block 406 forms each power of +5V, +12V, +24V, and -24V based on the source power supply incorporated through this AC power connector terminal 439, and supplies it to other the block of each.
[0215] The manipulator which is not illustrated is equipped with the mechanical component the upper and lower sides, right and left, order, and for carrying out a roll control for the carriage which has the gripper which operates having held at a time one optical information record medium 1 transmitted to the mail box through the mail slot 412 etc., the carriage attaching part holding this carriage, and carriage. The shape of an abbreviation rectangle is formed in that bottom surface part, it applies to the top-face section of JUKU equipment from the four corners of the shape of this rectangle, and four stanchions set up so that it might become perpendicular to a bottom surface part are prepared in the interior of JUKU equipment. a carriage attaching part -- carriage -- rotation before and after right and left -- free -- holding -- **** -- the both ends -- four stanchions -- meeting -- a carriage attaching part -- the upper and lower sides -- it has the stanchion grasping section which grasps a stanchion so that it may be movable.
[0216] A carriage mechanical component generates the driving force for having held the optical information record medium 1 by the gripper while it generates the driving force for carrying out migration control of such a manipulator up and down along with a stanchion and generates the driving force right and left, order, and for carrying out a roll control for carriage.
[0217] As shown in drawing 72 , the cantilevered suspension of the closing motion of an end is made free on the hinge 450, and a front door 407 pulls out the lower magazine 421, the up magazine 422, and the 1st and 2nd disk array 404,405, respectively, or can equip now with them by opening and closing this front door 407. Each magazine 421,422 has the box configuration contained in the form which carried out the laminating of the optical information record medium 1 of ten sheets contained by the cartridge, respectively in parallel to the bottom surface part of JUKU equipment, and the optical information record medium 1 is inserted from the tooth-back side (field side which carries out phase opposite at the transverse-plane side in which the front door 407 is formed when JUKU equipment is equipped with each magazine 421,422) of each magazine 421,422. Wearing of this optical information record medium 1 can be performed by once, when a user equips JUKU equipment with each magazine 421,422 which took out each magazine 421,422, contained manually and contained the optical information record medium 1. Moreover, a manipulator equips each magazine 421,422 with the optical information record medium 1 with which the inserted optical information record medium 1 was transmitted to the mail box, and was transmitted to this mail box by inserting the optical information record medium 1 through a mail slot 412. Thereby, each magazine 421,422 can be automatically equipped with the optical information record medium 1.
[0218] the 1st and 2nd disk arrays 404,405 -- respectively -- a RAID controller and the 1- it has the drive array which the 5th optical information record regenerative apparatus was connected, and was constituted.
[0219] Each optical information record regenerative apparatus has the disk insertion exhaust port, respectively, and the optical information record medium 1 is discharged by each optical information record regenerative apparatus from insertion or each optical information record regenerative apparatus through this disk insertion exhaust port. Moreover, it connects with the controller block 423 and a RAID controller controls each optical information record regenerative apparatus by control of the controller block 423 according to the recording method of RAID1, RAID3, or RAID5. In addition, each recording method of RAID1, RAID3, and RAID5 is chosen by the key stroke of the keypad 409 prepared in the front panel 408.
[0220] With this JUKU equipment, data are recorded by the recording method of RAID1, RAID3, or

RAID5 using a disk array 404,405. Thus, in order to record data, it is necessary to equip JUKU equipment with the optical information record medium 1 beforehand. There are the following two kinds in the wearing approach of the optical information record medium 1 for JUKU equipment.
[0221] The 1st wearing approach is an approach of opening a front door 407, taking out the lower magazine 421 and the up magazine 422, and equipping with the optical information record medium 1 manually to these magazines 421,422, as shown in drawing 72 .
[0222] The 2nd wearing approach is an approach of equipping at a time with one optical information record medium 1 through the mail slot 412 shown in drawing 73 . If a mail slot 412 is equipped with the optical information record medium 1, the controller block 423 will detect this, and will carry out drive control of the motor 413 for a transfer, and the optical information record medium 1 will be transmitted to a mail box. If the optical information record medium 1 is transmitted to a mail box, drive control is carried out in the vertical-movement operation motor 430, drive control will be carried out in the motor 424 for grip actuation, and the controller block 423 will carry out migration control to the disk stowage it is vacant in the magazine 421,422 in the optical information record medium 1 held by the gripper prepared at the manipulator, while carrying out migration control in the direction in which the manipulator is formed in the mail box. And drive control of the motor 424 for grip actuation is carried out, and the optical information record medium 1 held by the gripper is released in a disk stowage. The controller block 423 controls each part to repeat such a series of wearing actuation, and to perform it, whenever the optical information record medium 1 is inserted through a mail slot 412.
[0223] Thus, if each magazine 421,422 is equipped with the optical information record medium 1, the controller block 423 will control a manipulator by the 1st wearing approach or the 2nd wearing approach, and will transmit the optical information record medium 1 contained by the lower magazine 421 or the up magazine 422 to the 1st disk array 404 or 2nd disk array 405 by it. Wearing of the optical information record medium 1 of five sheets of each disk array 404,405 is attained respectively, the 1st disk array 404 will be equipped with five in the optical information record medium 1 of a total of 20 sheets contained by each magazine 421,422 with the manipulator, and the 2nd disk array 405 will be equipped with other five sheets.
[0224] When recording data, by operating a keypad 409, a user chooses a desired recording method out of the recording method of RAID1, RAID3, or RAID5, operates a keypad 409, and specifies the recording start of data. In a disk array 404,405, they are the connector terminal 435 for RS232C, or **. The data which should be recorded are supplied through the 1 and 2nd connector terminal 437,438 for SCSI. If the recording start of data is specified, the controller block 423 will control each disk array 404,405 through the RAID controller formed in each disk array 404,405 according to the selected recording method so that record of data is performed.
[0225] With this JUKU equipment, the hard disk drive unit in RAID using the conventional hard disk drive unit is transposed to the optical information record regenerative apparatus in which five sets are prepared at a time by each disk array 404,405, and data are recorded according to the recording method chosen from the recording methods of RAID1, RAID3, or RAID5. In addition, in this JUKU equipment, the interface of data is not limited to what the **** explained and was mentioned.
[0226] By the way, in the optical information record regenerative apparatus concerning the gestalt of this operation, a copy protection and a security protection are easily realizable like the gestalt of the 1st operation. moreover, the optical information record medium 1 which recorded the information (for example, various kinds of software) on varieties that the modulation patterns of a reference beam differed -- a user -- providing -- the information on the modulation pattern of a user's reference beam which responds for asking and makes information on various kinds refreshable -- a hook -- it becomes realizable [the data communications service of providing according to an individual for pay as information].
[0227] moreover, the hook for taking out predetermined information from the optical information record medium 1 -- you may make it create the modulation pattern of the phase of a reference beam used as information based on the information on the proper of the individual who becomes a user As information on an individual proper, there is a pattern of a personal identification number, a fingerprint, a voiceprint, and the iris etc.
[0228] drawing 74 showed an example of the configuration of the important section at the time of creating the modulation pattern of the phase of a reference beam based on the information on an individual proper as mentioned above in the optical information record regenerative apparatus concerning the gestalt of this operation -- it is. The individual humanity news input section 501 into which an optical information record regenerative apparatus inputs the information on the proper of individuals, such as a fingerprint, in this

example, Based on the information inputted from this individual humanity news input section 501, create the modulation pattern of the phase of a reference beam and the phase space modulator 117 is received if needed at the time of informational record or playback. The phase modulation pattern encoder 502 which gives the information on the created modulation pattern and drives the phase space modulator 117, While publishing the card 504 which recorded the information on the modulation pattern created by this phase modulation pattern encoder 502 When equipped with this card 504, it has card issue / input section 503 which sends the information on the modulation pattern currently recorded on that card 504 to the phase modulation pattern encoder 502.

[0229] In case a user records information on the optical information record medium 1 in the example shown in drawing 74 using the optical information record regenerative apparatus concerning the gestalt of this operation, the individual humanity news input section 501 is received. When the information on the proper of individuals, such as a fingerprint, is inputted, the phase modulation pattern encoder 502 Based on the information inputted from the individual humanity news input section 501, the modulation pattern of the phase of a reference beam is created, to the phase space modulator 117, the information on the created modulation pattern is given at the time of informational record, and the phase space modulator 117 is driven at it. It is matched with the modulation pattern of the phase of the reference beam created by this based on the information on the proper of the individual who is a user, and information is recorded on the optical information record medium 1. Moreover, delivery and card issue / input section 503 publish the card 504 which recorded the information on a modulation pattern that the information on the modulation pattern which created the phase modulation pattern encoder 502 had been sent by card issue / input section 503.

[0230] In order to reproduce the information recorded as mentioned above from the optical information record medium 1, like the time of record, a user inputs the information on an individual proper to the individual humanity news input section 501, or equips card issue / input section 503 with a card 504.

[0231] When the information on an individual proper is inputted to the individual humanity news input section 501, based on the information inputted from the individual humanity news input section 501, the phase modulation pattern encoder 502 creates the modulation pattern of the phase of a reference beam, to the phase space modulator 117, gives the information on the created modulation pattern at the time of informational playback, and drives the phase space modulator 117 at it. If the modulation pattern of the phase of the light at the time of record and the modulation pattern of the phase of the reference beam at the time of playback are in agreement at this time, the information on desired will be reproduced. In addition, even if it inputs the information on the same individual's proper to the individual humanity news input section 501, in order to prevent that a modulation pattern which is different in the time of record and playback is created in the phase modulation pattern encoder 502, even if the information inputted from the individual humanity news input section 501 is different to some extent, in the phase modulation pattern encoder 502, the same modulation pattern may be made to be created.

[0232] On the other hand, when card issue / input section 503 is equipped with a card 504, delivery and the phase modulation pattern encoder 502 give the information on a modulation pattern that the information on the modulation pattern currently recorded on the card 504 has been sent to the phase modulation pattern encoder 502 to the phase space modulator 117, and card issue / input section 503 drives the phase space modulator 117. Thereby, the information on desired is reproduced.

[0233] The configuration of others in the gestalt of this operation, an operation, and effectiveness are the same as the gestalt of the 1st operation.

[0234] In addition, although this invention is not limited to the gestalt of each above-mentioned implementation, for example, address information etc. was beforehand recorded on the address servo area 6 in the optical information record medium 1 by the embossing pit with the gestalt of each above-mentioned implementation It sets in the address servo area 6, without preparing an embossing pit beforehand. The laser beam of high power is irradiated alternatively at the part near the protective layer 4 of the hologram layer 3, and it may be made to format by changing the refractive index of the part alternatively by recording address information etc.

[0235] Moreover, as a component which detects the information recorded on the hologram layer 3, not a CCD array but an MOS mold solid state image sensor and a digital disposal circuit may use the smart photosensor (for example, refer to reference (O plus E, September, 1996, and "No.202 and the 93-99th Paige").) accumulated on 1 chip. This smart photosensor has a large transfer rate, and since it has a high-speed calculation function, it becomes possible [high-speed playback being attained, for example, reproducing at the transfer rate of G bit-per-second order] by using this smart photosensor.

[0236] moreover, when a smart photosensor is used as a component which detects the information especially

recorded on the hologram layer 3 Instead of recording address information etc. on the address servo area 6 in the optical information record medium 1 by the embossing pit The address information of a predetermined pattern etc. is beforehand recorded by the same approach as record using the holography in a data area 7, pickup is changed into the same condition as the time of playback also at the time of a servo, and you may make it a smart photosensor detect the address information etc. In this case, a basic clock and the address can be directly obtained from the detection data of a smart photosensor. A tracking error signal can be acquired from the information on the location of the playback pattern on a smart photosensor. Moreover, a focus servo can be performed by driving an objective lens 12 so that the contrast of the playback pattern on a smart photosensor may become max. Moreover, it is possible to carry out by driving an objective lens so that the contrast of the playback pattern on a smart photosensor may become max about a focus servo at the time of playback.

[0237] Moreover, in the gestalt of each operation, the information on the modulation pattern of a reference beam and the information on wavelength may be made to be given to a controller 90 from external host equipment.

[0238]

[Effect of the Invention] As explained above, in an optical information recording device according to claim 1 to 4, phase modulation pattern information is generated based on individual humanity news, and the reference beam for record is generated based on this phase modulation pattern information. And information light and the reference beam for record are irradiated by the information recording layer so that these opticals axis may be arranged on the same line, so that the information which should be recorded on an information recording layer with the interference pattern by interference with information light and the reference beam for record may be recorded by record optical system. Therefore, according to this invention, while being able to constitute record optical system small, the effectiveness that a security protection is easily realizable is done so.

[0239] Moreover, in an optical information recording device according to claim 3, record optical system irradiates information light and the reference beam for record from the same field side to an information recording layer. Therefore, according to this invention, the effectiveness that record optical system can be constituted smaller is done so.

[0240] Moreover, the optical information recording device according to claim 4 is equipped with an issue means to publish the record medium for authentication which recorded phase modulation pattern information. Therefore, according to this invention, the effectiveness that the record medium for authentication which recorded the phase modulation pattern information generated based on individual humanity news can be published is done so.

[0241] In an optical information regenerative apparatus according to claim 5 to 9, while the reference beam for playback is generated based on the 2nd phase modulation pattern information and the reference beam for playback is irradiated by the information recording layer of an optical information record medium according to playback optical system, only when the 2nd phase modulation pattern information is in agreement with the 1st phase modulation pattern information, the playback light generated from an information recording layer is collected. Playback optical system performs exposure of the reference beam for playback, and collection of playback light so that the optical axis of the reference beam for playback and the optical axis of playback light may be arranged on the same line. Therefore, according to this invention, while being able to constitute playback optical system small, the effectiveness that a security protection is easily realizable is done so.

[0242] Moreover, in an optical information regenerative apparatus according to claim 7, playback optical system collects playback light from the same field side as the side which irradiates the reference beam for playback in an information recording layer. Therefore, according to this invention, the effectiveness that playback optical system can be constituted smaller is done so.

[0243] Moreover, in an optical information regenerative apparatus according to claim 8, a phase modulation pattern information acquisition means generates the 2nd phase modulation pattern information based on the 2nd inputted individual humanity news. Therefore, according to this invention, the effectiveness that the 2nd individual humanity news can be inputted and information can be reproduced from an optical information record medium is done so.

[0244] Moreover, in an optical information regenerative apparatus according to claim 9, a phase modulation pattern information acquisition means acquires the 2nd phase modulation pattern information from the record medium for authentication. Therefore, according to this invention, the effectiveness that information is reproducible from an optical information record medium using the record medium for authentication is

done so.

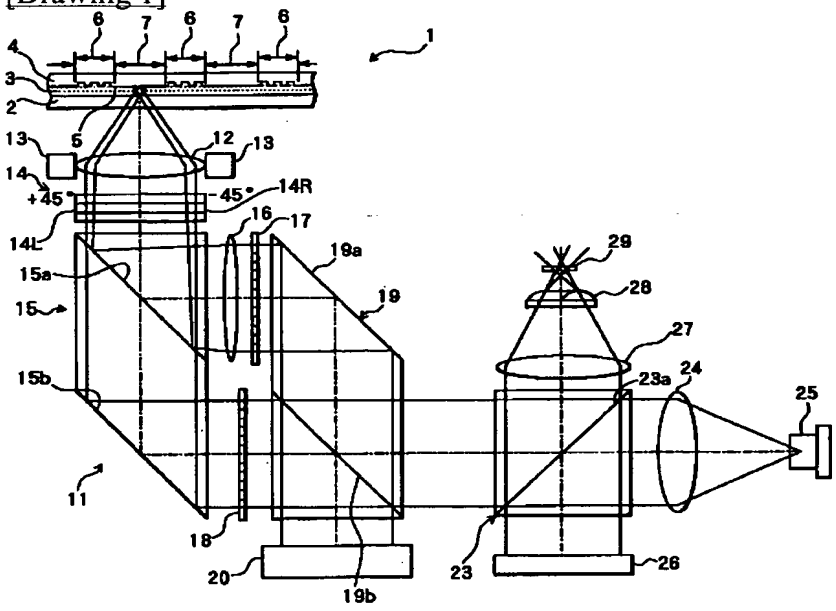
[Translation done.]

* NOTICES *

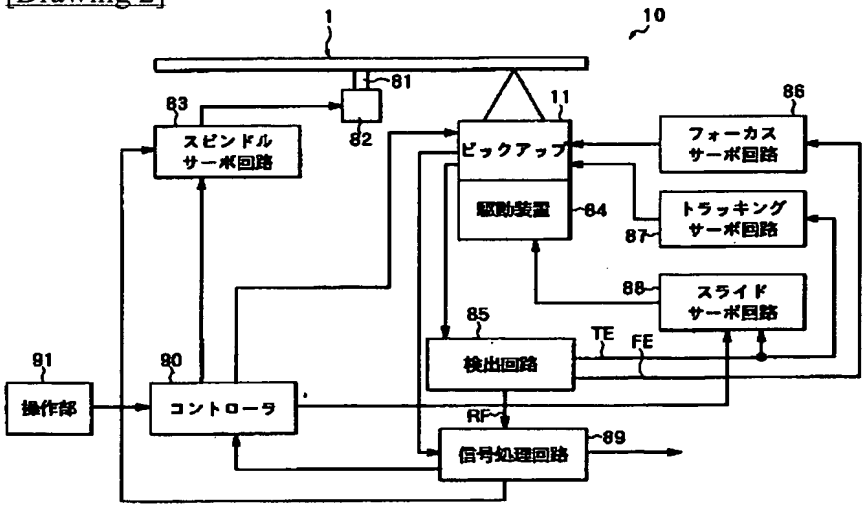
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

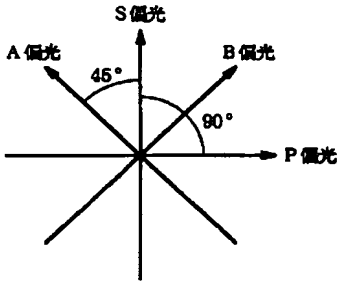
[Drawing 1]



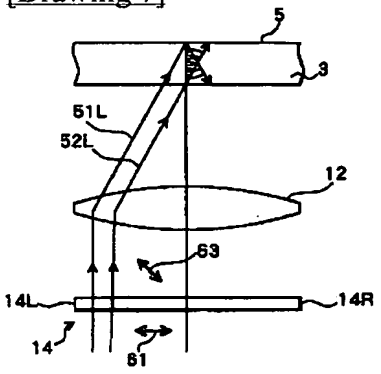
[Drawing 2]



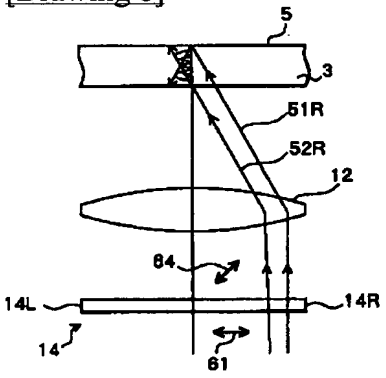
[Drawing 5]



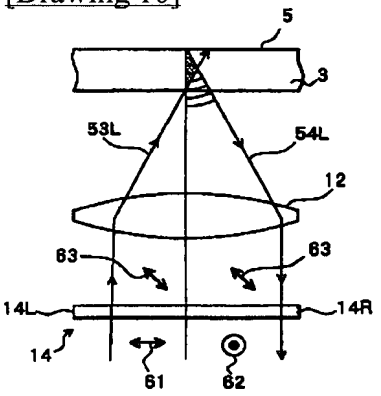
[Drawing 7]



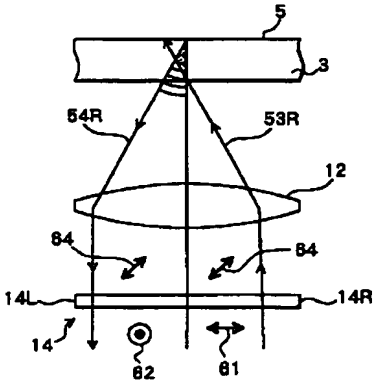
[Drawing 8]



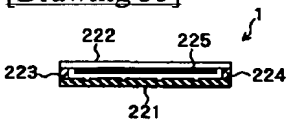
[Drawing 10]



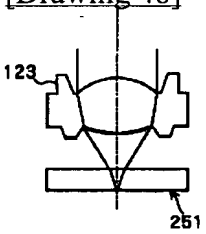
[Drawing 11]



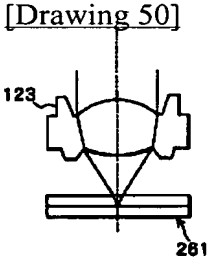
[Drawing 35]



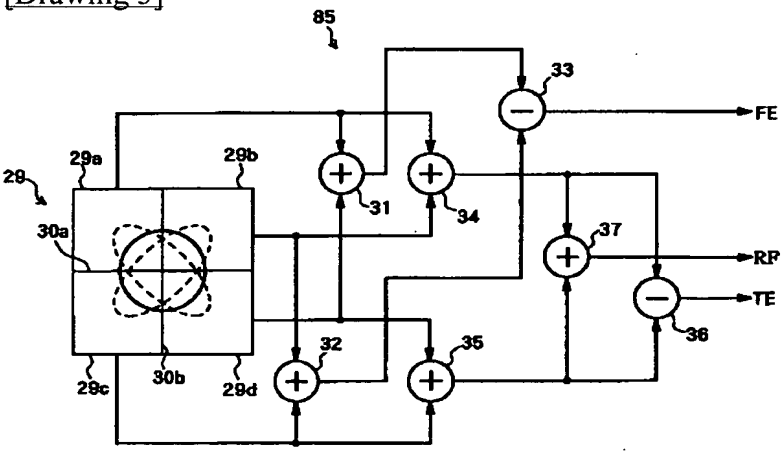
[Drawing 48]



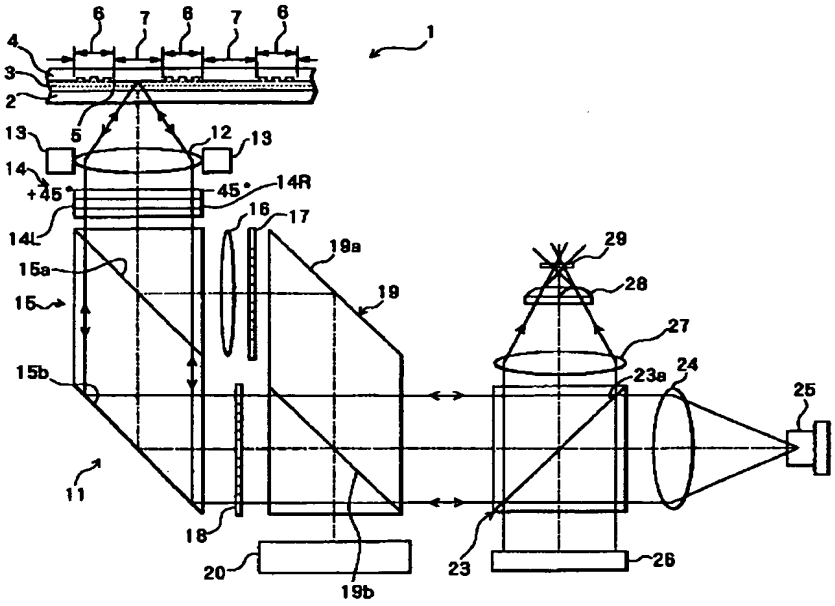
[Drawing 50]



[Drawing 3]



[Drawing 4]



[Drawing 12]

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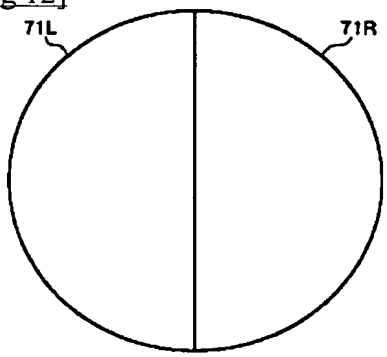

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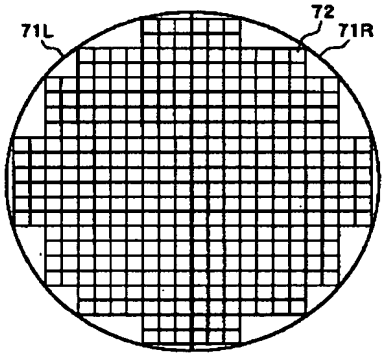

[Drawing 13]

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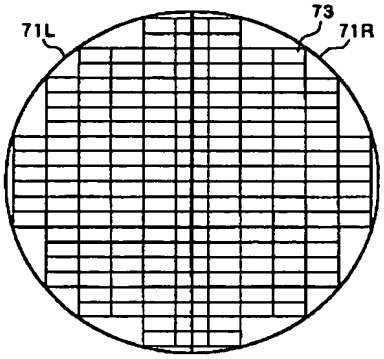

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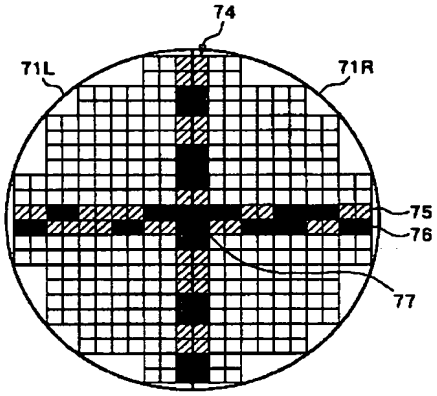
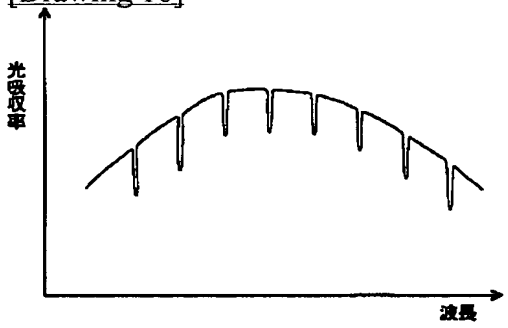
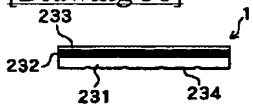


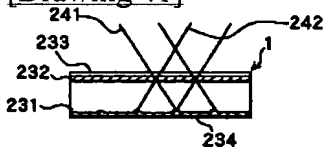
[Drawing 16]



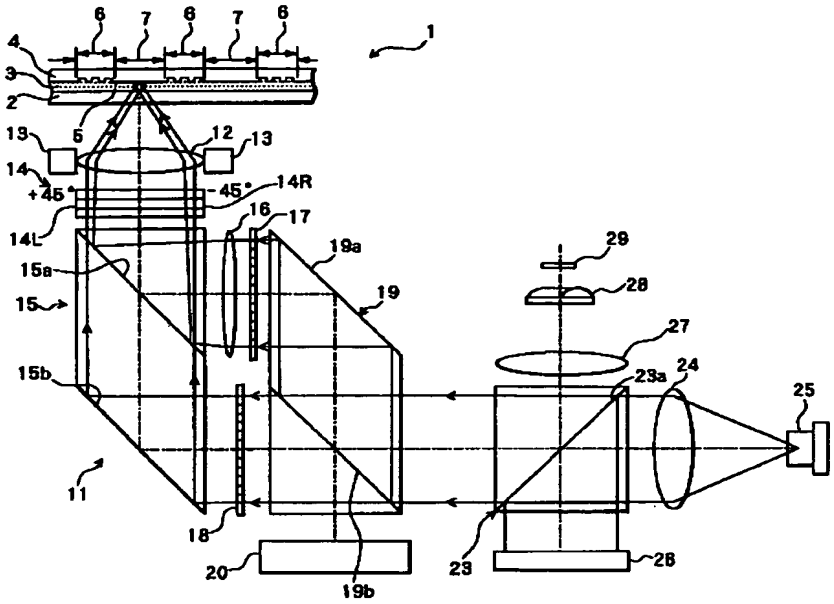
[Drawing 38]



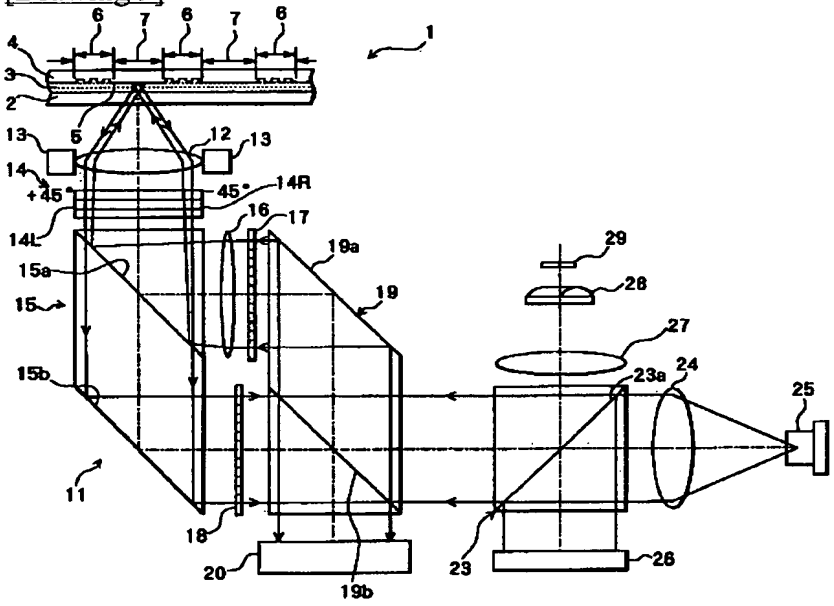
[Drawing 41]



[Drawing 6]



[Drawing 9]



[Drawing 14]

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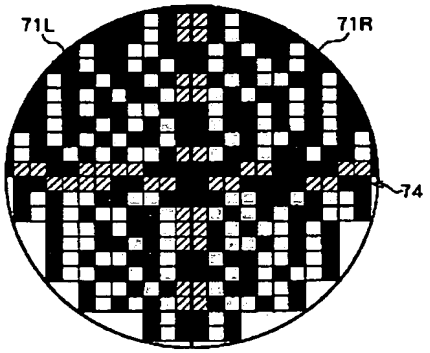

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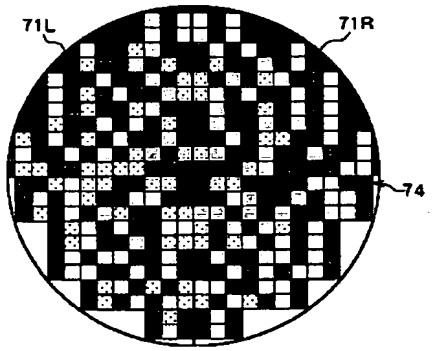

[Drawing 19]

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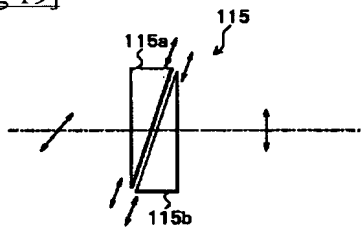

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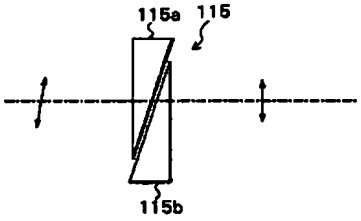
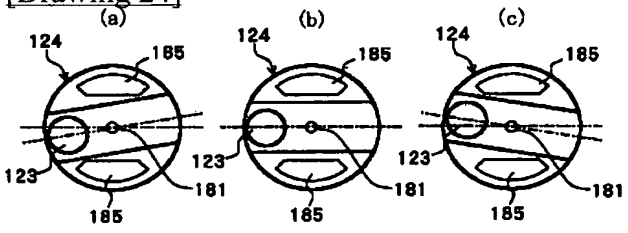


[Drawing 24]



[Drawing 15]

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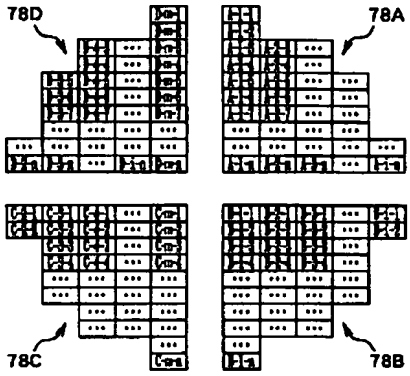

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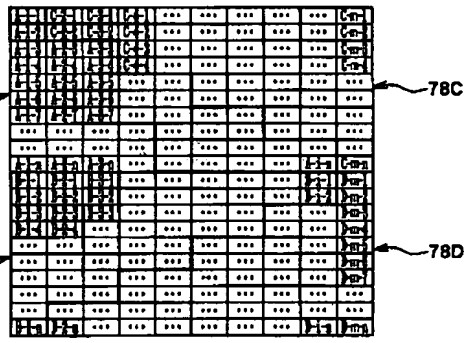
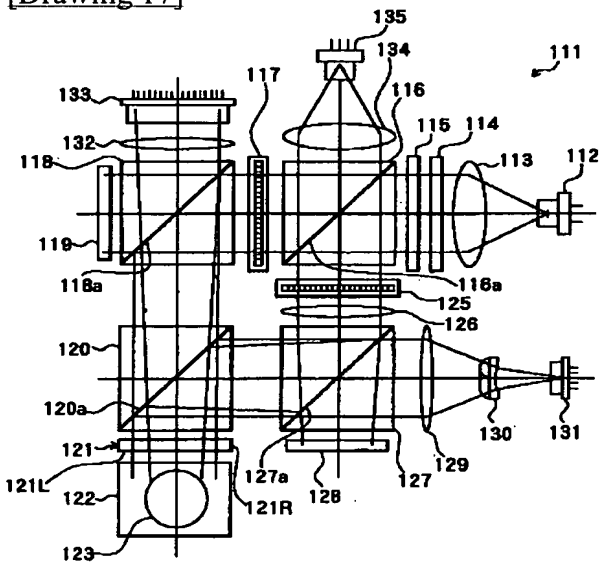


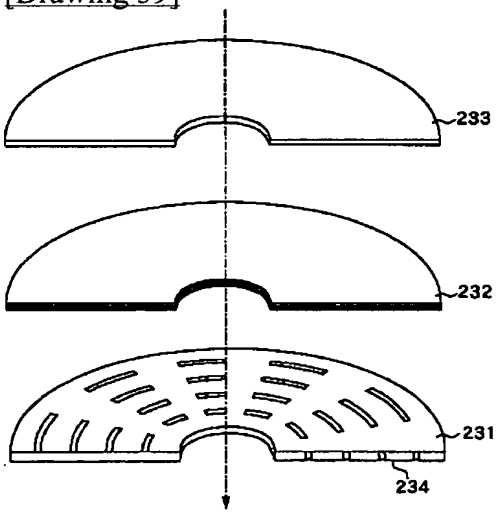
[Drawing 17]



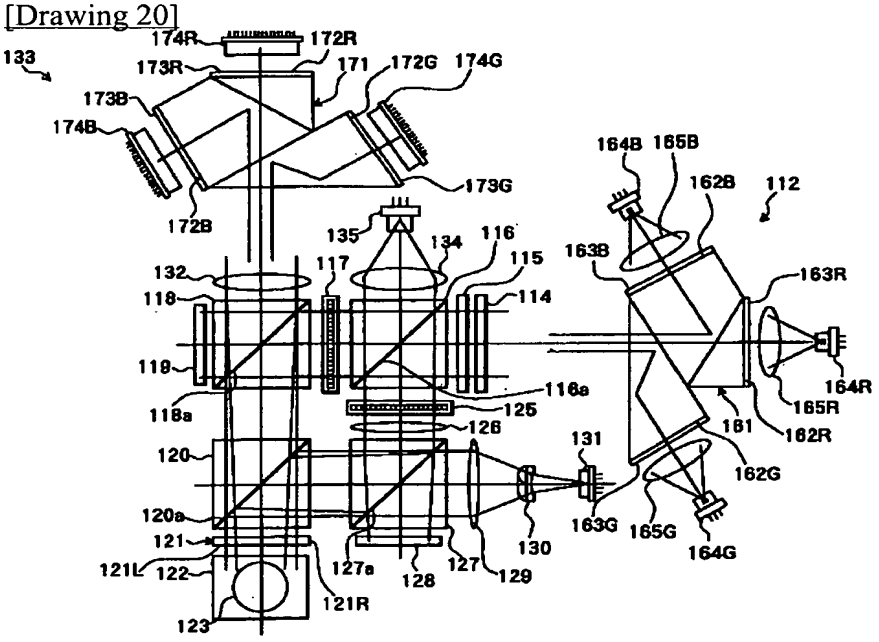
[Drawing 18]

ID=000020

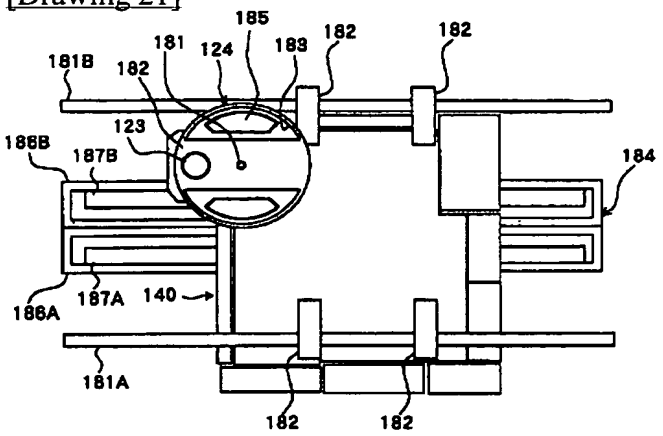
[Drawing 39]



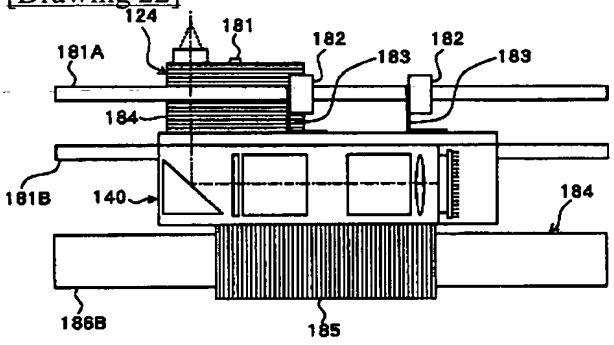
[Drawing 20]



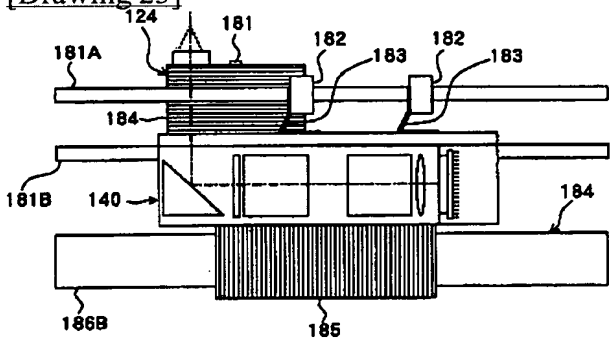
[Drawing 21]



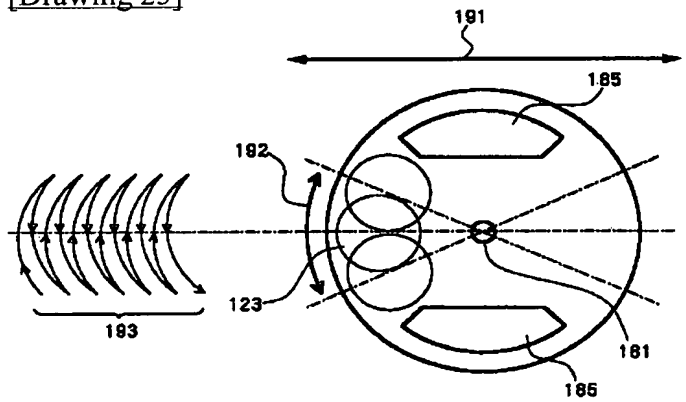
[Drawing 22]



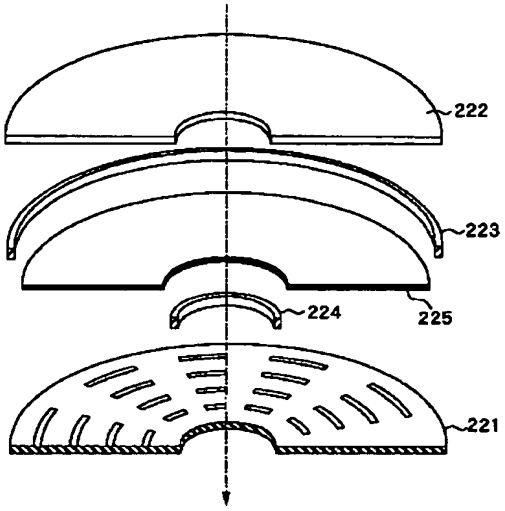
[Drawing 23]



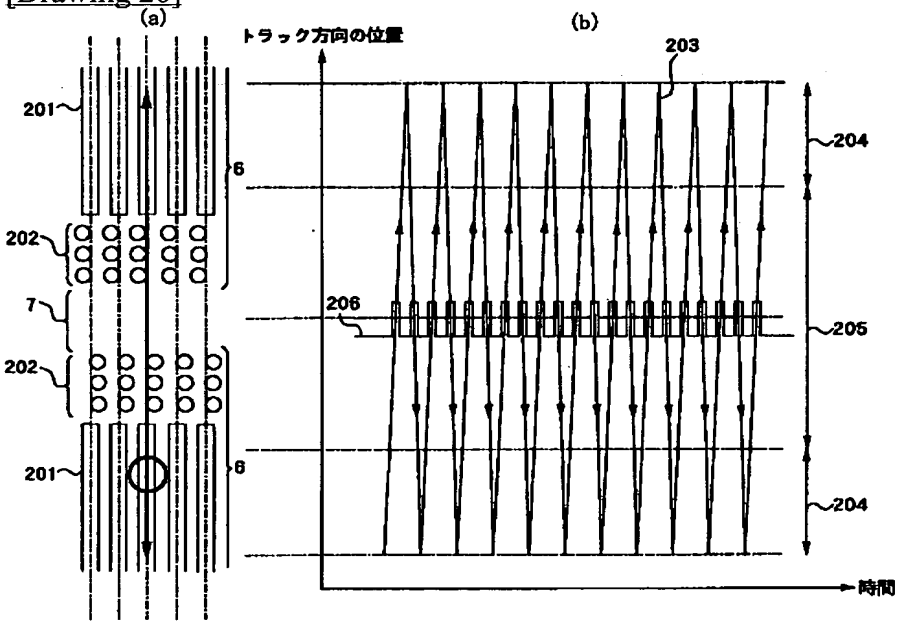
[Drawing 25]



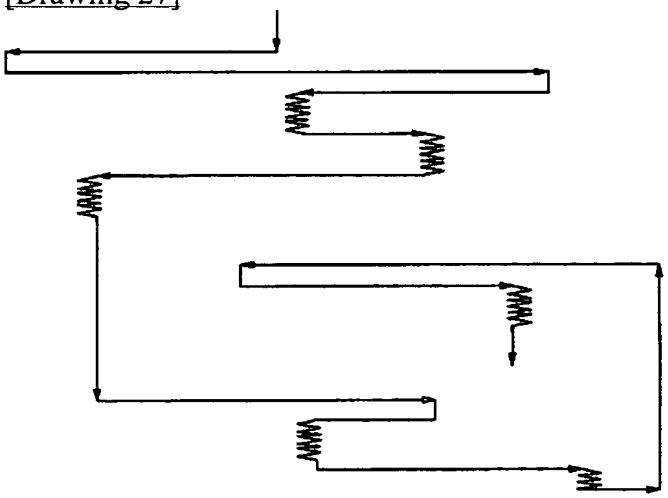
[Drawing 36]



[Drawing 26]



[Drawing 27]



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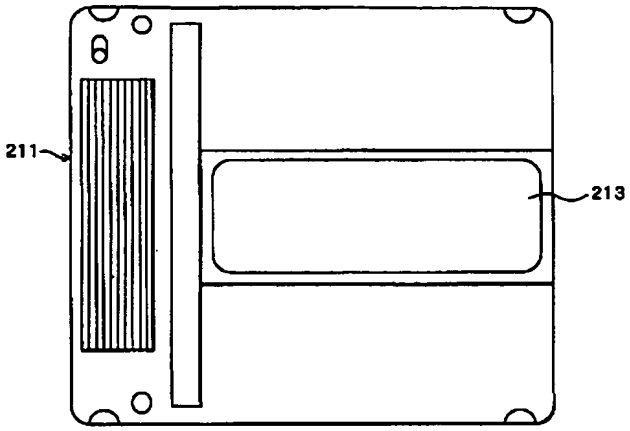

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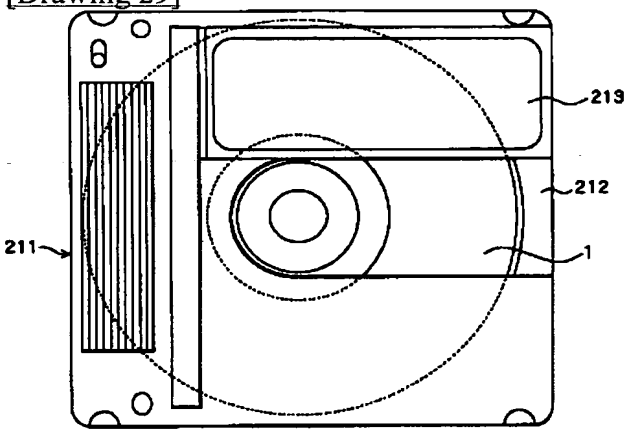

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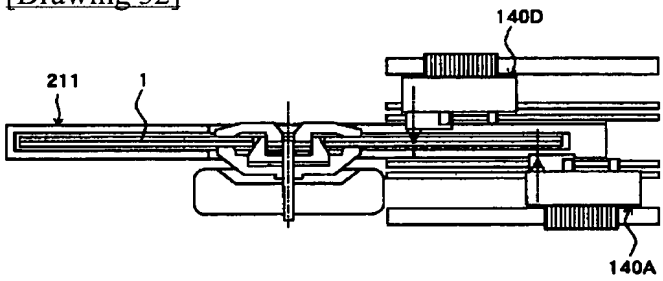

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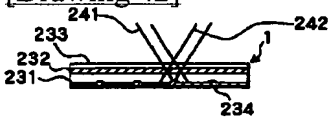

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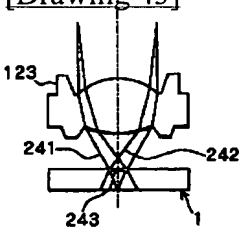

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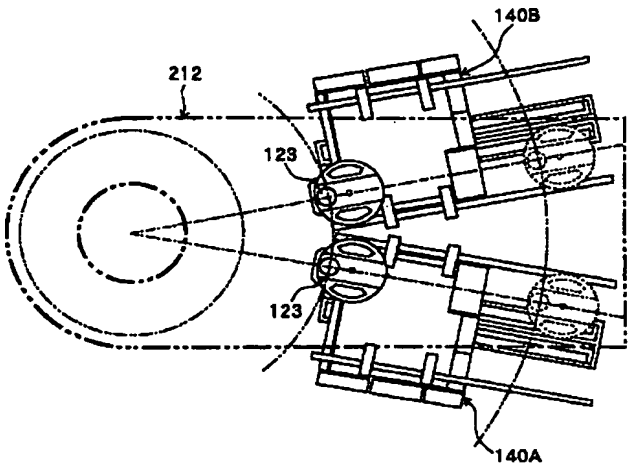

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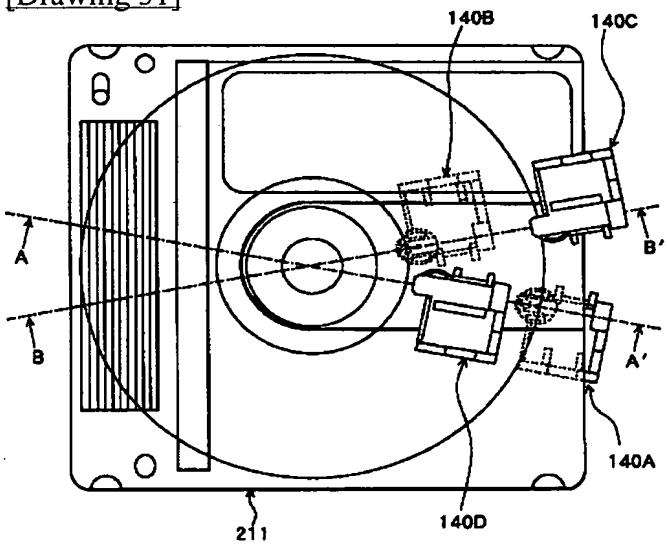

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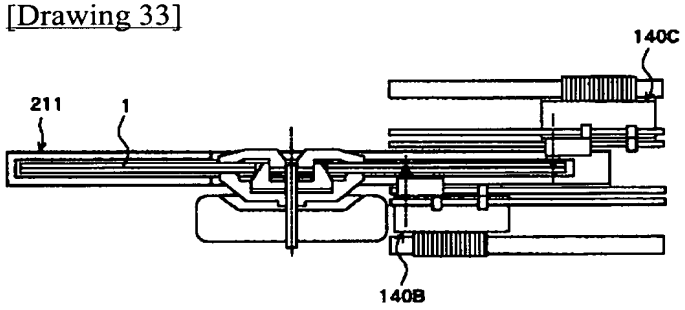

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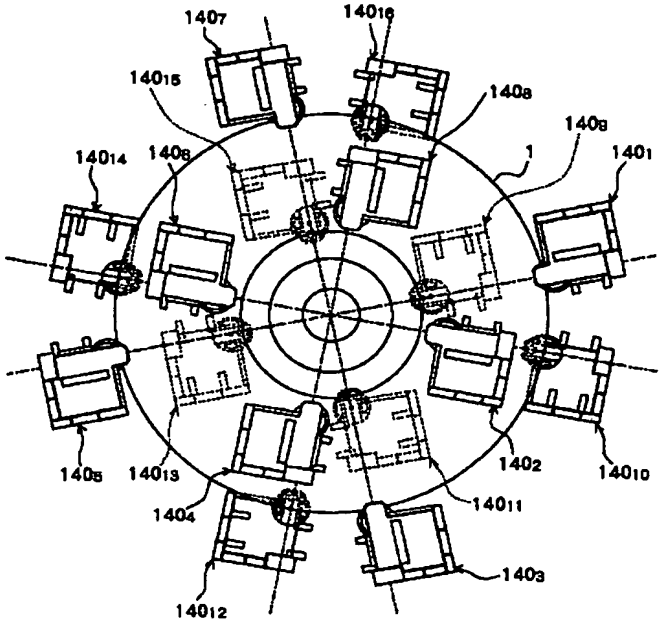

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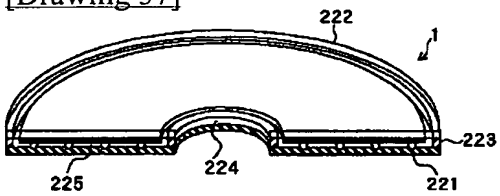

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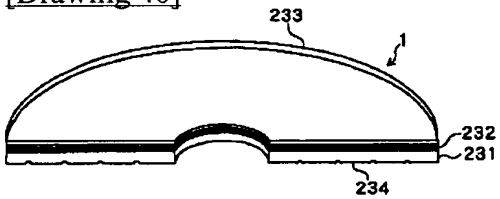

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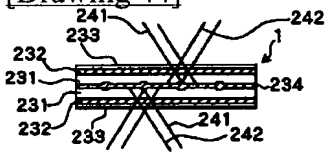

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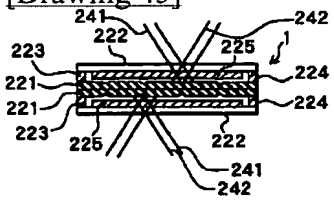

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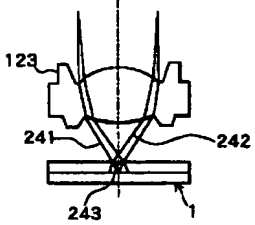

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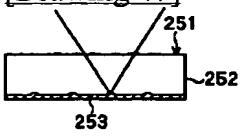

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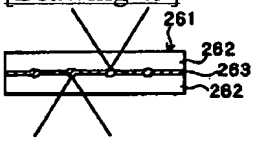

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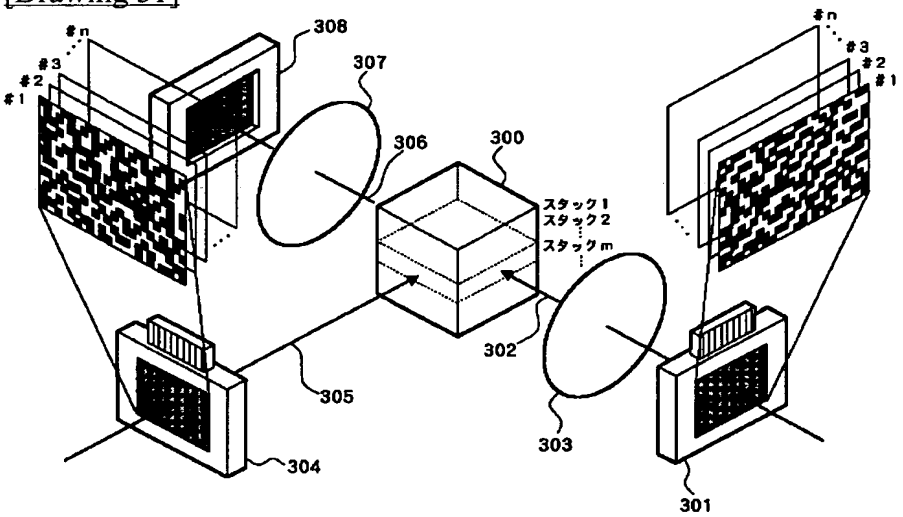

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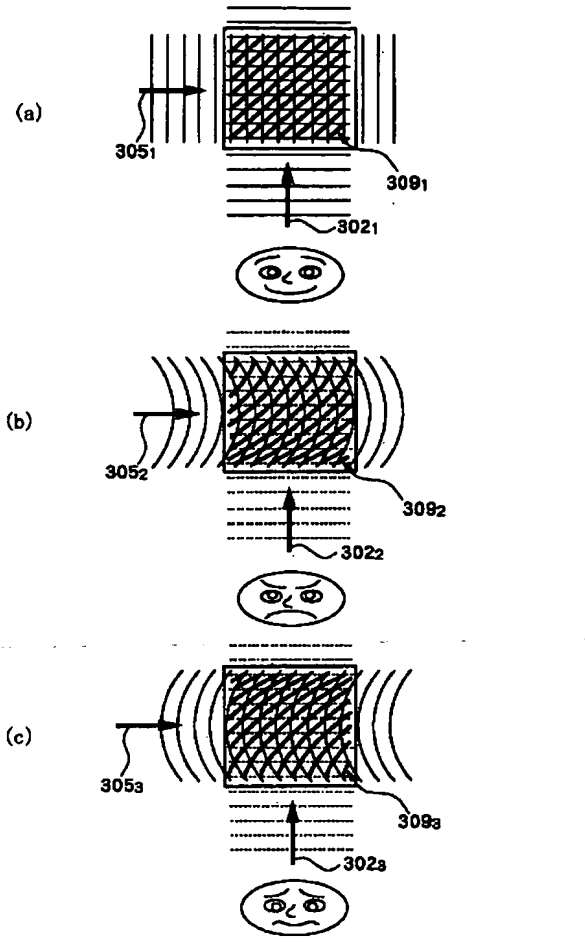

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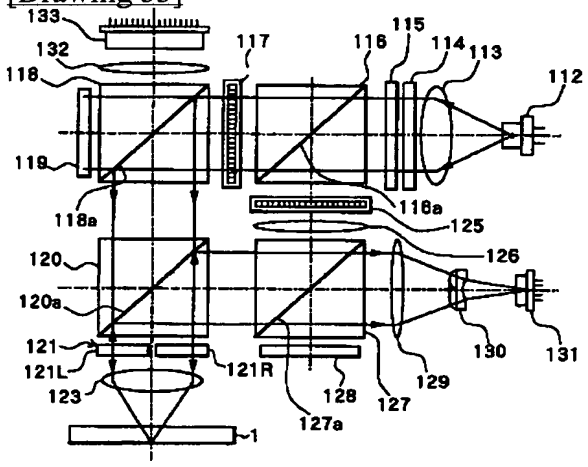

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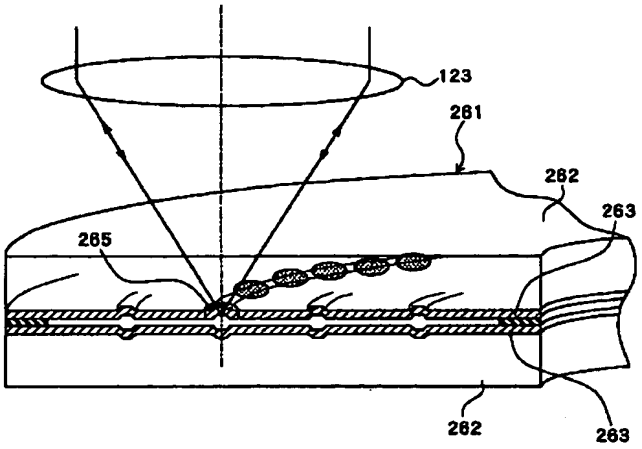

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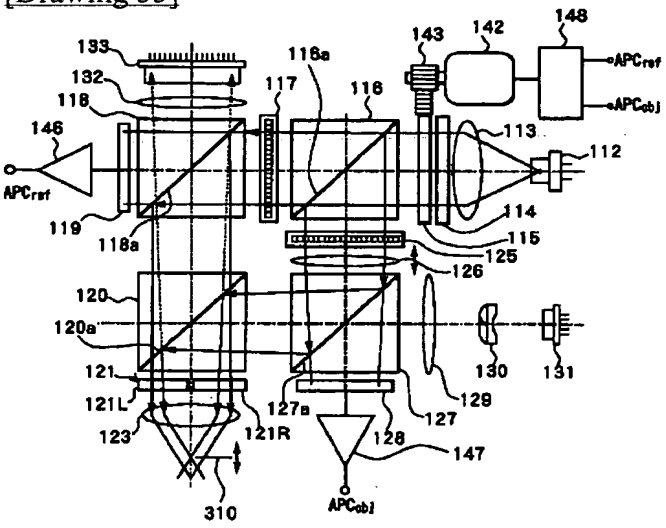

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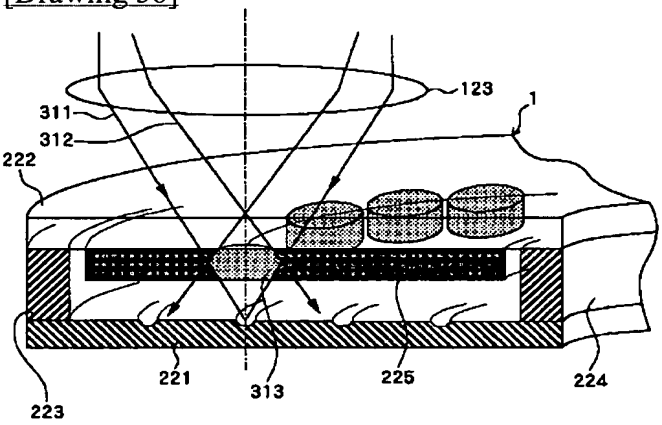

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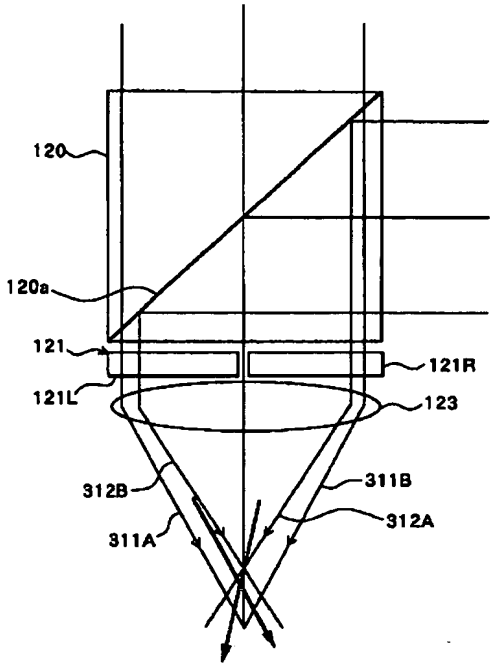

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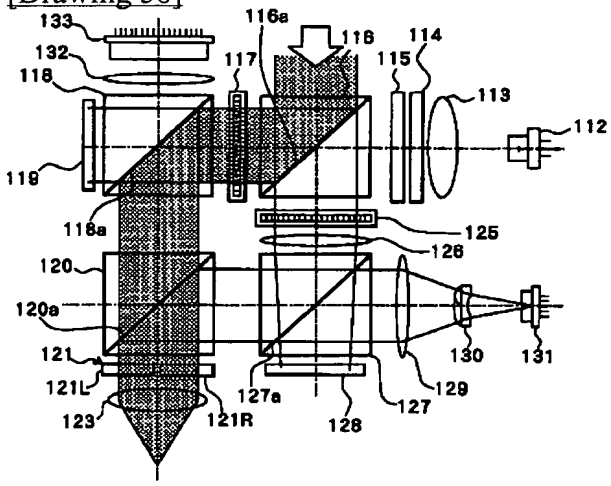

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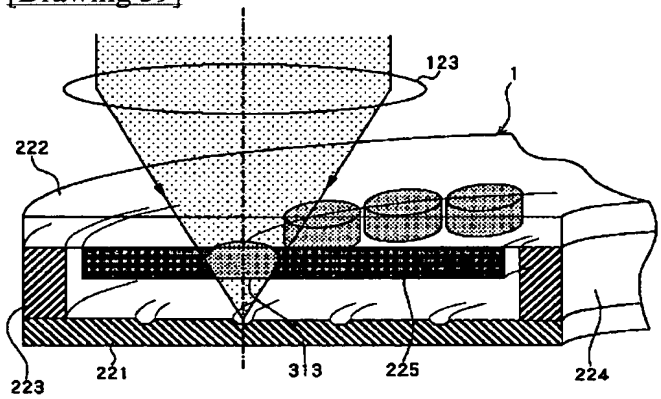

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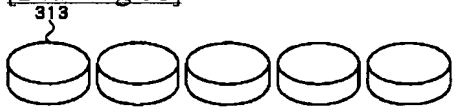

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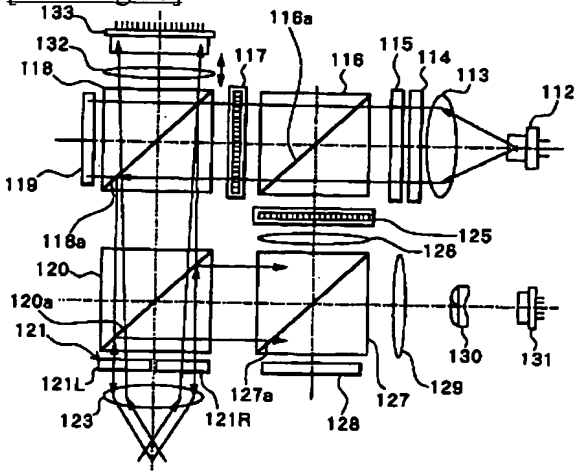

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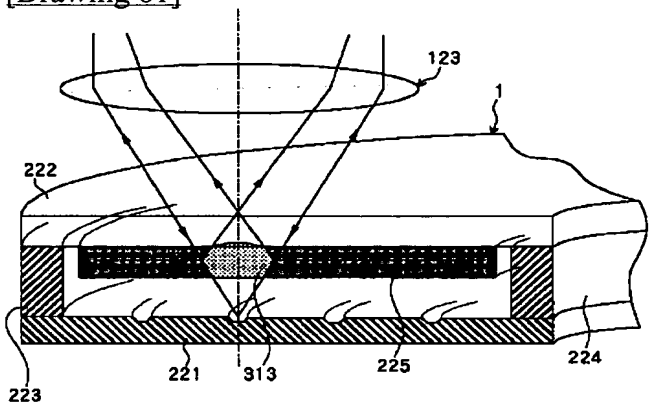

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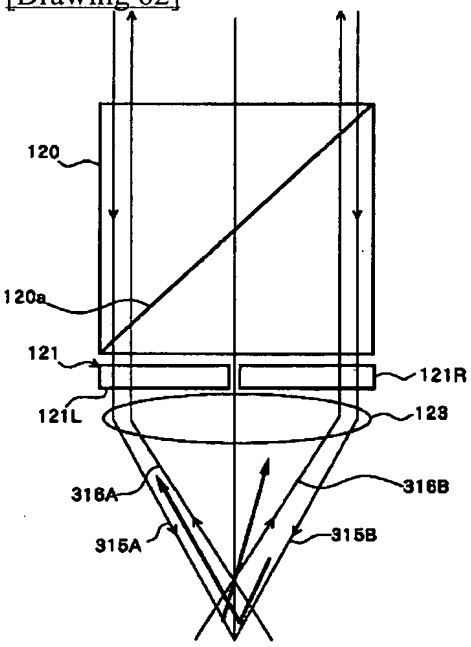

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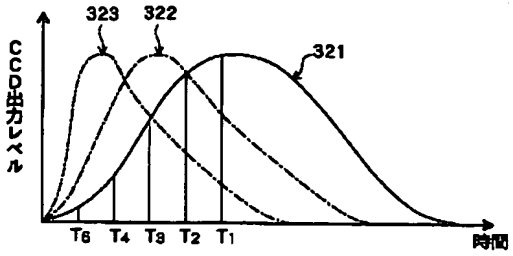

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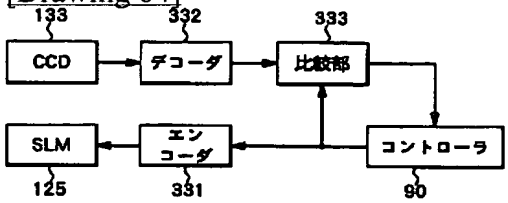

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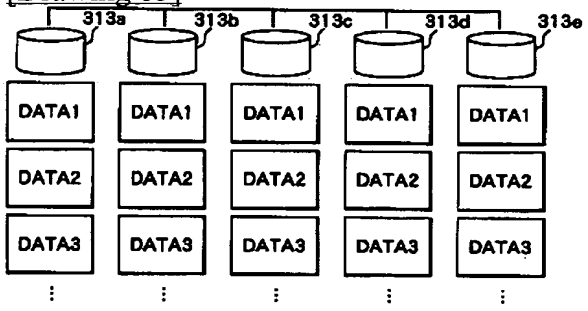

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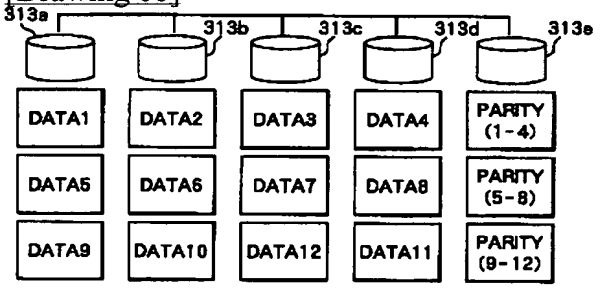

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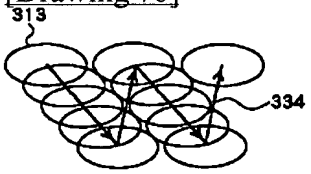

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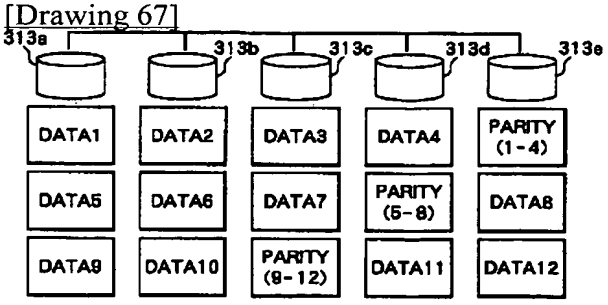

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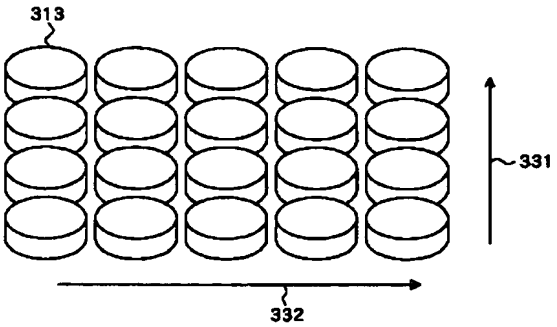

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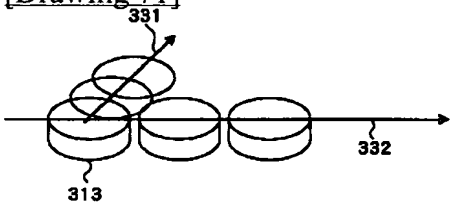

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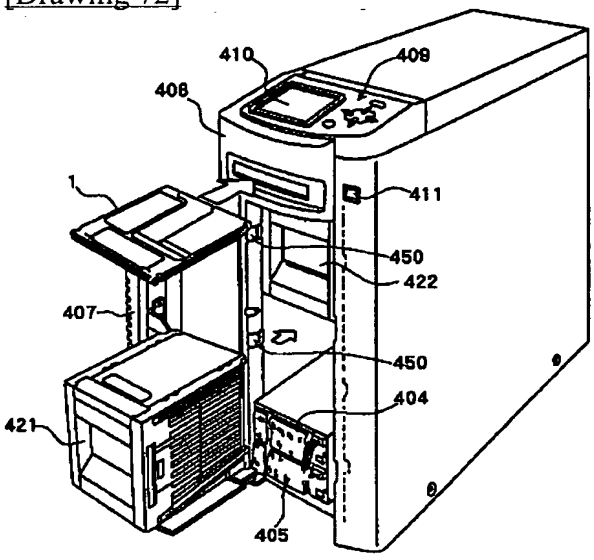

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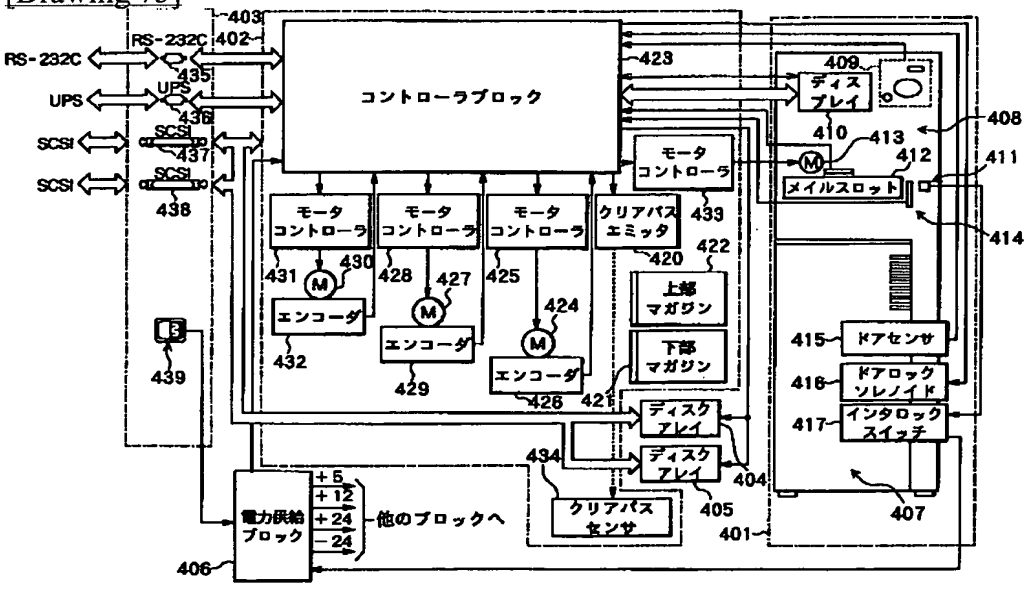

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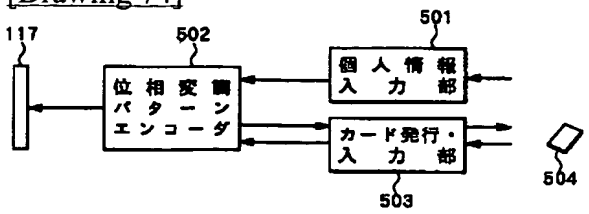

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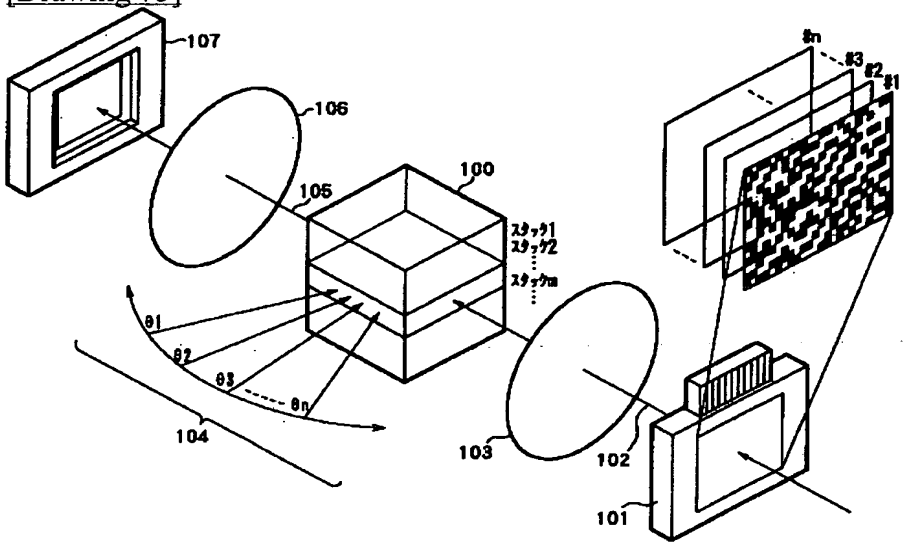

[Translation done.]